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See Notice Inside

March 15, 1976

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ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

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NUCLEAR SCIENCE ABSTRACTS

A semimonthly publication of the USERDA Office of Public Affairs
Published by the ERDA Technical Information Center

Nuclear Science Abstracts provides the only comprehensive abstracting and indexing coverage of the international nuclear science literature. It covers scientific and technical reports of the U. S. Energy Research and Development Administration and its contractors, other U. S. Government agencies, other governments, universities, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Each issue of *Nuclear Science Abstracts* includes four indexes: subject, personal author, corporate author, and report number.

The following organizations scan and abstract the nuclear science literature in their respective countries for input to the International Nuclear Information System of the International Atomic Energy Agency. By special agreement, the input to INIS is simultaneously sent to the ERDA Technical Information Center to enhance the timeliness of coverage of that literature in *Nuclear Science Abstracts*.

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United Kingdom Atomic Energy Authority
Zentralstelle für Atomkernenergie-Dokumentation (West Germany)

Numerous organizations, societies, and publishers throughout the world provide *Nuclear Science Abstracts* with advance page-proof copy of their publications.

A list of the journals scanned regularly and the abbreviations used appears in the January 15 issue of *Nuclear Science Abstracts* and is supplemented in the July 15 issue. The January 15 issue also describes the scope and arrangement of the subject matter covered in *Nuclear Science Abstracts*. The subject matter covered is also described in TID-4552, *Subject Scope of Nuclear Science Abstracts*, available free from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830. An outline of the subject categories appears in the Contents of each issue.

NOTICE

The publication of *Nuclear Science Abstracts* is planned to be discontinued after Vol. 33, No. 12, dated June 30, 1976. *Atomindex*, published by the International Atomic Energy Agency and a product of the International Nuclear Information System (INIS), will provide essentially identical literature coverage, subject scope, abstracting and indexing with that of *NSA*. For all practical purposes the two journals are identical. The Energy Research and Development Administration, formerly the Atomic Energy Commission, has supported the concept and development of INIS for several years. At this time, it is quite apparent that the decentralized scanning, abstracting and indexing on a country-by-country basis is reliable and successful. Consequently, it is no longer necessary for the United States to bear the entire burden of publishing an abstract journal covering the world's nuclear literature. ERDA will continue to provide coverage of U. S. nuclear literature to INIS.

Atomindex is available on a subscription basis in the United States from UNIPUB, P. O. Box 433, Murray Hill Station, New York, New York 10016, for $150 per year including cumulative indexes. ($110 per year without cumulative indexes.) For others, *Atomindex* is available from the International Atomic Energy Agency, Publications Section, P. O. Box 590, A-1011, Vienna, Austria, at the same price.

ERDA's new journal, *ERDA Energy Research Abstracts (ERA)*, will contain abstracts and indexes to all literature of ERDA origin as well as nonnuclear energy information generated by foreign countries with which ERDA has agreements for cooperation. *ERA* is available to government agencies on the same basis as *NSA* and on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information.

The public may obtain *ERA* from the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402. The annual subscription rate for the 12 regular issues including an annual cumulative index is $119 for domestic subscribers, and $148.75 for foreign subscribers. Individual issues will be priced at $7.40 domestic, and $9.25 foreign. Separate annual index cumulations will cost $30.50 domestic, and $38.15 foreign.

INDEXES TO *NSA*

Comprehensive indexes appear in each issue and are cumulated at the end of each volume. The report number indexes will be cumulated on both a volume and two-volume basis. Multivolume cumulations have been issued as indicated above.

All documents abstracted are indexed by subjects and personal authors. Report literature is indexed also by corporate author and report number. Each of these indexes in every issue is preceded by an introduction explaining in detail the organization of the index and the principles by which it is compiled. The reader is referred to these explanations for information not found in the brief summaries below.

Personal Authors

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

SOLDAN, D.W., Shipping container for a bottle of radioactive material, 32:20442
SOLDAT, J.K., Dosimetry of the radioactive noble gases, 32:19918 (BNWL-SA-4813)
SOLOMAKHA, D.A., Measurement of the 1.15-μm wavelength of a helium--neon laser, 32:19855

Subjects

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

Examples:

URANIUM ORES/GEOCHEMISTRY
Change of uranium concentration in plagioclase of various zones of microcline--albite--oligoclase pegmatites of Karelia, 32:19704
URANIUM ORES/LEACHING
Preparation of uranium compounds (Patent), 32:19329
URANIUM ORES/MINING
The uranium mining and its importance for the energy supply, 32:19701
URANIUM ORES/ORE PROCESSING
Supplies for the fuel cycle for Spanish nuclear power plants, 32:19702
URANIUM OXIDES
See also URANIUM DIOXIDE
URANIUM OXIDES U3O8

Corporates

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

20457 (LA-5954) 100-MHz POWER AMPLIFIER DESIGN AND CONTROL FOR A HEAVY-ION ACCELERATOR. Lunsford, J. S.; Shipley, J. P.; Sutton, J. **(Los Alamos Scientific Lab., N. Mex. (USA)).** Jul 1975. 11p. Dep. NTIS $4.00.

is indexed as:

LOS ALAMOS SCIENTIFIC LAB., N.MEX. (USA)
100-Mhz power amplifier design and control for a heavy-ion accelerator, 32:20457 (LA-5954)
Characterization of transuranic solid wastes from a plutonium processing facility, 32:19398 (LA-5993-MS)
Electrical breakdown and tracking characteristics of pulsed high voltages in cryogenic helium and nitrogen, 32:19495 (LA-UR-75-1032)
Engineering concepts for laser-fusion reactor applications, 32:19493 (LA-UR-75-736)
Evaluation of pre-impregnated resin-glass systems for insulating superconducting magnets, 32:19583 (LA-UR-75-1099)

Report Numbers

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. While not reports, patents and conference papers are indexed here as a matter of convenience.

L-	(Misc.)	
9389	32:20494	See N-74-35219
LA-		
2429	32:20210	Dep. NTIS, $12.00
5931	32:21563	Dep. NTIS, $5.45
LA-tr-		
75-14	32:21506	Dep. NTIS, $7.75
75-26	32:19253	Dep. NTIS, $4.00
LA-UR-		
75-736	32:19493	Dep. NTIS, $4.00
75-791	32:20772	Dep. NTIS, $4.50
75-1331	32:19238	Dep. NTIS, $4.00
LBL-		
2874	32:19889	Dep. NTIS, $9.25
3633	32:21097	Dep. NTIS, $13.50
LFEN-	(Portugal)	
165-b	32:21507	INIS

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Energy Research and Development Administration reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

Dissertations from *Dissertation Abstracts International, Part B* that are included in *Nuclear Science Abstracts* are available from Xerox University Microfilms, 300 North Zeeb Road, Ann Arbor, Michigan 48106.

Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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The Administrator of the Energy Research and Development Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1978.

Volume 33, Number 5 March 15, 1976

NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

8826 (AECL-5230) CHEMISTRY AND MATERIALS DIVISION PROGRESS REPORT, APRIL 1, 1975–JUNE 30, 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1975. 145p. (PR-CMa-33). Dep. NTIS (US Sales Only) $7.00. AECL $3.00.

Research is reported in the following areas: solid state, general chemistry, physical chemistry, and materials science. Publications resulting from the research are listed. (LK)

8827 (MLM-2241) MOUND LABORATORY ACTIVITIES FOR THE DIVISION OF PHYSICAL RESEARCH. Progress Report, January-June 1975. Fitzharris, R. E. (ed.). (Mound Lab., Miamisburg, Ohio (USA)). 11 Nov 1975. Contract E-33-1-GEN-53. 53p. Dep. NTIS $5.45.

Activities in research programs devoted to isotope preparation, properties of D_2 and He at low temperature, metal hydrides, separation chemistry, and separation research are reported. A separate abstract was prepared for each of the five areas of study. (JRD)

For abstracts of individual sections see: 8861, 8869, 8870, 8892, and 8893.

Analytical and Separations Chemistry

Refer also to abstract 9738.

8828 (UCID-15644-75-1) GENERAL CHEMISTRY DIVISION QUARTERLY REPORT, APRIL–JUNE 1975. Harrar, J. E. (comp. and ed.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Sep 1975. Contract W-7405-Eng-48. 45p. Dep. NTIS $5.25.

The progress report is divided into four sections, each of which has been abstracted and indexed separately for NSA/ERA. (JGB)

For abstracts of individual sections see: 8829, 8845, and 10296.

8829 (UCID-15644-75-2, pp 1) ANALYTICAL RESEARCH AND DEVELOPMENT FOR THE WHITNEY PROGRAMS. Automation and Instrumentation. Computer Automation of the Cary Model 17I Spectrophotometer. Haugen, G. R.; Bystroff, R. I.; Downey, R. M.; Fisher, E. R.; Newton, J. C.; Richardson, J. H. 3 Sep 1975.

In General Chemistry Division quarterly report, April–June 1975. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

In the area of automation and instrumentation, progress in the following studies is reported: computer automation of the Cary model 17I spectrophotometer; a new concept for monitoring the concentration of water in gases; on-line gas analysis for a gas circulation experiment; and count-rate-discriminator technique for measuring grain-boundary composition. In the area of analytical methodology and measurements, progress is reported in the following studies: separation of molecular species by radiation pressure; study of the vaporization of $U(thd)_4$, (thd equals 2,2,6,6-tetramethylheptane-3,5-drone); study of the vaporization of $U(C_8H_8)_2$; determination of ethylenic unsaturation in polyimide resins; and, semimicrodetermination of hydroxyl and amino groups with pyromellitic dianhydride (PMDA). (JGB)

Activation and Nuclear Reaction Procedures

Refer also to abstracts 10234 and 11307.

8830 (CONF-751009-4) ELEMENTAL ANALYSIS OF WATER AND AIR SOLIDS BY NEUTRON ACTIVATION ANALYSIS. Bate, L. C.; Lindberg, S. E.; Andren, A. W. (Wisconsin Univ., Madison (USA). Water Chemistry Lab.). 1975. 16p. Dep. NTIS $4.50.

From international nuclear and atomic activation analysis conference; Gatlinburg, Tennessee, USA (14 Oct 1975).

Instrumental neutron activation analysis was used to determine the elemental concentrations in water and air solids samples collected on Nucleopore and Whatman filters from the Walker Branch Watershed. The results from this study show that the trace element concentrations removed by water from the watershed vary seasonally, as well as geographically. The data point up the usefulness and versatility of absolute neutron activation analysis. The NBS Standard Orchard Leaves were assayed in a similar manner, and good agreement was obtained between results here and standard values. (auth)

8831 (INIS-mf-1789) DIFFERENTIAL ANALYSIS OF URANIUM AND THORIUM THROUGH THE DELAYED NEUTRON METHOD. de Magalhaes Alves, J. M. N. (Minas Gerais Univ., Belo Horizonte (Brazil). Instituto de Ciencias Exatas). 1973. 100p. (In Portuguese). INIS.

The frequency with which uranium and thorium appear together in Brazilian minerals suggests the importance of a viability study for a simple method of relative dosage of these two elements. The delayed neutron method was used to search for a technique, sufficiently simple and rapid, for analysis of this uranium, or, at least, to obtain a confirmation test of uranium analysis in samples containing thorium. The method developed here can be considered simple and rapid, in spite of the necessity of use of the computer for analysis of activity arising from the simultaneous disintegration of uranium and thorium. (auth)

8832 (KFK-2203) ASSAY OF NUCLEAR MATERIAL FOR PLUTONIUM BY THE NEUTRON COINCIDENCE TECHNIQUE. Boehnel, K. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Sep 1975. 150p. (In German). Dep. NTIS (US Sales Only) $7.00.

Thesis. Submitted to Univ. of Karlsruhe, Ger.

In assays for plutonium the neutron coincidence technique is often used. This method which is based on measuring spontaneous fission rates is examined both experimentally and theoretically. A novel coincidence unit is described, which works in effect without deadtime and which therefore has advantages over the currently used design. For waste samples a principle for measurement is described which avoids space dependence effects by rotating the probe in an asymmetric detector. Formulas are developed for the statistical error and various effects of deadtimes are discussed. Further it is shown that neutron multiplication in the sample is an important source of errors, especially when the (α,n)-background is neglected. (auth)

8833 (LYCEN-75-10) ANALYTICAL APPLICATIONS OF THE $^{12}C(d,p)$ REACTION. Treatment of Experimental Spectra. Engerran, J. A. (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire; Lyon-1 Univ., 69 (France)). 1975. 55p. (In French). INIS.

The nuclear (d,p) reaction induced on carbon and oxygen at medium energies (1 to 4 MeV) has been used for the determination of very small quantities (less than a monolayer) as well as of the in-depth distribution. With respect to the first feature of this reaction, chemisorption was studied for the mixture CO/O_2 at

the surface of a polycrystalline sample of platinum. An adapted irradiation detection set-up is described. Obtaining the in-depth distribution leads to the more general case of treatment of experimental spectra. Owing to the results given by the classical methods of deconvolution or convolution, a joint procedure was chosen for the application. A trial function is determined by a convolution process, to be used as initial function in an iterative method. Convergence is then easily achieved avoiding Gibbs phenomena. As a main application, carbon profile determination is obtained for a boron matrix. (FR)

8834 POSSIBILITIES OF DETECTION OF VALUABLE METALS IN MANGANESE NODULES UTILIZING A ^{252}Cf NEUTRON SOURCE. Specht, S.; Haunreiter, H. (Technische Univ. Muenchen, Garching (F. R. Germany). Inst. fuer Radiochemie). Atomkernenergie; 26: No. 1, 53-57(1975). (In German)

From 5th seminar on activation analysis; Koeln, F. R. Germany (19 Sep 1974). 4 figs.; 2 tabs.; 12 refs.

A rather continuous method is required, by which the metals manganese, copper, nickel, cobalt, and iron, or some of them, could be determined in situ, for short analysis times with an analytical error of about 20 to 50%. The possibility of performing such analyses by aid of the capture gamma radiation induced by a ^{252}Cf neutron source was tested experimentally, simultaneous of referring to the maximum analyzing time of 10 min demanded by application. Manganese nodules were irradiated and decay gamma radiation as well as capture gamma radiation were measured individually. Within the short analyzing time, only manganese is detectable with a relative error of 1% referring to 10 g sample material. The measurement of capture gamma radiation (up to 10 MeV) verified the detection of the five metals of interest (Mn, Fe, Cu, Ni). (auth)

8835 ISOTOPIC CONTENT DETERMINATION IN IRRADIATED FUEL BY NEUTRON TRANSMISSION ANALYSIS. Priesmeyer, H. G.; Harz, U. (Kiel Univ. (F. R. Germany). Inst. fuer Reine und Angewandte Kernphysik). Atomkernenergie; 25: No. 2, 109-113(1975).

From KTG-special meeting "long-term behavior"; Stuttgart, F. R. Germany (25 Feb 1975). 3 figs.; 1 tab.; 6 refs.

Experiences and results from neutron transmission analysis of resonances in irradiated nuclear fuel for isotopic assay are reported. The measurements were made with the fast-chopper time-of-flight spectrometer of the University of Kiel at FRG-1 in Geesthacht. Samples with different U enrichments and burnups have been investigated. The absolute contents of U 235, U 238, Pu 239, Xe 131, Sm 152 and Cs 133 can be determined. High radioactivity of the samples does not affect the measurements, which in principle may be carried out non-destructively. (auth)

8836 ACTIVATION ANALYSIS USING SHORT-LIVED NUCLIDES AND ISOMERIC TRANSITIONS. Grass, F. (Atominstitut der Oesterreichischen Hochschulen, Vienna). Atomkernenergie; 25: No. 4, 243-248(1975).

12 figs.; 2 tabs.; 6 refs.

A review is given of the work done at the Atominstitut during the last years on short-lived nuclides and isomeric states. In this work the term "short-lived" includes nuclides up to half-lives of 1 s. The methods and some applications are discussed and examples are given. (auth)

8837 ANALYSIS FOR TRACE MERCURY CONCENTRATION. I. Critical Evaluation of Current Procedures. II. A Proposed Method for Determination by Instrumental Neutron Activation Analysis. Litman, R. New York; City Univ. of New York (1975). 125p. University Microfilms Order No. 75-21,338.

Thesis (Ph. D.).

Current methods of sample pretreatments, digestion, lyophilization and extraction, have been found to lead to considerable loss of mercury, at an initial mercury concentration of 1 mu g/g, and less. Storage of solutions of mercury at concentrations of less than 1 mu g/ml, in glass, Teflon and polyethylene containers, leads to losses by adsorption. Electrochemical reduction of mercury to the metal, and subsequent volatilization, is postulated as the mechanism of loss from the samples studied during lyophilization. A method of instrumental neutron activation analysis, which obviates the above pretreatments, has been developed for mercury concentrations as low as 1 ng/ml. (Diss. Abstr. Int., B)

8838 NEUTRON ACTIVATION ANALYSIS: STUDENT PROJECTS. Williamson, T. G. (Univ. of Virginia, Charlottesville). pp 44-45 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).

From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

8839 FRICTION WELDED SEALS FOR POLYETHYLENE IRRADIATION CONTAINERS. Cashwell, R. J.; Walsh, R. C. (Univ. of Wisconsin, Madison). pp 86-87 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).

From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

8840 STUDIES ON NEUTRON ACTIVATION ANALYSIS FOR THE MEASUREMENT OF SODIUM IN NAILS AS A SCREENING TEST FOR CYSTIC FIBROSIS. Savory, J.; Leitner, S. S. (Univ. of North Carolina, Chapel Hill). Ann. Clin. Lab. Sci.; 4: No. 6, 413-419(1974).

The present study points out the simplicity and ease of using fingernails and toenails to measure electrolyte levels as a test for cystic fibrosis. Procedures and various effects on the ranges of values for different categories of healthy and diseased subjects are discussed and the limitations of the method are indicated. (auth)

Chemical and Spectral Procedures

Refer also to abstracts 9899 and 9945.

8841 (AEMC/Chem-134) DETERMINATION OF IRON IN THE THORIUM BEARING ORE OF KHYBER AGENCY. Nagi, F. I.; Ali, A.; Anwar, J. (Atomic Energy Minerals Centre, Lahore (Pakistan)). Jul 1975. 18p. Dep. NTIS (US Sales Only) $4.00.

Analytical methods used to determine iron in the thorium bearing ore are described in this report. The absorption spectra of the $[Fe(CN)_6]-Fe$ and $Fe(SCN)_3$ complexes were studied and calibration curves for both the methods are established. The accuracy of the methods was compared by independent analysis of the samples at PINSTECH by a titrametric method. (auth)

8842 (GA-A-13536) ANALYTICAL CHEMISTRY DEPARTMENT, ANNUAL REPORT, 1974. (General Atomic Co., San Diego, Calif. (USA)). 27 Oct 1975. Contract E(04-3)-167. 49p. Dep. NTIS $5.45.

Progress is reported in the following areas of research most of which is related to the analysis of HTGR materials: gamma ray spectroscopy and radiochemistry; HTGR fuel reprocessing support; HTGR fuel manufacturing support; resin kernel program; doped fuel kernel program; TRIGA fuel fabrication support; and, miscellaneous procedures. (JGB)

8843 (INIS-mf-1788) SEPARATION, CONCENTRATION, AND DETERMINATION OF METALS IN URANIUM BY EXTRACTION CHROMATOGRAPHY. Study of the Al_2O_3-tri-n-octilamine - $HCl-UO_2Cl_2$ System. dos Anjos de Jesus, G. (Sao Paulo Univ. (Brazil). Instituto de Quimica). 1973. 76p. (In Portuguese). INIS.

A method has been developed for the separation and pre-concentration of the elements cadmium, silver, gold, mercury, bismuth, zinc, lead and tin, present as impurities in uranium salts. This separation was effected using chromatography extraction in the Al_2O_3-tri-n-octylamine-HCl system. A column support of alumina (grains) covered with a double layer of isopor and amine (TCA) was used. The amine was initially dissolved in alcohol. The retention capacity of other materials such as: celite, silica-gel and active charcoal was evaluated and, in addition their possible use as support materials was assessed. An evaluation was made of the effect of the feed solution composition on the retention of the above cited elements by the column material. More specifically the influence of the ligand ion concentration (chloride), the uranium concentration and the free hydrogen ion concentration were studied. Other parameters of interest in the elution of these elements, namely eluent, temperature of elution and chloride ion concentration in solution were also studied. With the exception of lead, all elements were well retained in, and well eluted from the Al_2O_3-TOA column, when both pure solutions (HCl 0.5M) and solutions of uranyl chloride (up to 150 gU/l) were used. Both qualitative and quantitative analysis of the separated elements were effected using atomic absorption spectrophotometry, polarography and molecular spectrophotometry. (INIS)

8844 (KFK-2177) DETERMINATION OF MICROAMOUNTS OF URANIUM IN WASTE SOLUTIONS. Netzer, S.; Kuhn, E.; Birringer, K. J.; Groll, P. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Heisse Chemie). Jul 1975. 23p. (In German). Dep. NTIS (US Sales Only) $4.25.

A method for the determination of microamounts of uranium in presence of high amounts of fission and corrosion products is described. Uranium is separated by reversed-phase chromatography on a small column, packed with Voltalef micro and impregnated with TOPO. For the direct photometric determination uranium is eluted by TAM dissolved in ethanol/pyridine. The efficiency of the separation, using a suitable scrub-solution, was

tested with solutions of simulated inactive fission and corrosion products. The reproducibility of the method, with 24 μg of uranium, is ± 2.5%. (auth)

8845 (UCID-15644-75-2, pp 29) SPECIAL PROJECTS. Automation of a Mass Spectrometer for the National Center for Toxicological Research (NCTR). Newton, J. C.; Brand, H. R.; Bystroff, R. I.; Elliott, J. R.; Pomernacki, C. L. 3 Sep 1975.

In General Chemistry Division quarterly report, April–June 1975. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

Progress is reported in the following studies: automation of a mass spectrometer for the national center for toxicological research (NCTR); automation of the Davies-Gray/New Brunswick Laboratory method for the determination of U; real-time materials control in a nuclear fuel plant; simulation modeling of mixed-oxide fuel-rod fabrication plants; pilot, laboratory-automation project with the National Environmental Research Center, Cincinnati, Ohio; thallium in human erythrocyte membranes; an x-ray photoelectron spectroscopy study; ESCA study of sulfur-bearing particulates; and chemical and statistical analysis of an inventory of precious metal at the LLL metal finishing shop. (JGB)

8846 MULTI-ELEMENT ANALYSIS OF BIOLOGICAL TISSUE BY PROTON-INDUCED X RAY EMISSION SPECTROSCOPY. Kemp, K. (Danish Atomic Energy Commission, Risoe); Jensen, F. P.; Moeller, J. T.; Gyrd-Hansen, N. Phys. Med. Biol.; 20: No. 5, 834-838(Sep 1975).

X-ray emission spectroscopy has become of increasing importance for trace element analysis in investigations of environmental pollution; bombardment with protons (1 to 10 MeV) yields the lowest detection limits for multi-element analysis. A description is given of the development of preparative techniques for samples of rat liver tissue, and the performance of these samples when analyzed by x-ray emission spectroscopy. Self-supporting, freeze-dried cryostat sections of liver (60 μm thick) were found to provide the most suitable sample, since these had both the lowest background radiation and a reasonable mechanical strength. In addition, 2 mm thick freeze-dried sections were analyzed, because these allowed a direct determination of the concentrations of heavy elements. (These latter samples were only suitable for the determination of a few heavy elements). The freeze-drying technique, although a very gentle method of dehydration, may result in the evaporation of the most volatile components (e.g. Hg compounds). The analysis detected 16 to 19 elements in each sample, with limits of 0.5 to 2 ppm in dry matter for elements heavier than Ti. It is concluded that this sample preparation technique is suitable for multi-element analysis of liver tissue by proton-induced x-ray emission spectroscopy. The detection limits were found to be sufficient for determination of more than 10 trace elements in liver tissue from unburdened rats. (UK)

8847 KHIMICHESKII ANALIZ MORSKIKH OSADKOV. (Chemical Analysis of Marine Sediments). Ostroumov, E. A. (ed.). Moscow; Izdatel'stvo Nauka (1975). 160p.

In connection with the wide interest in studies of the seas and oceans, the necessity for developing new analytical methods has arisen. A collection of six articles on the theory and practice of chemical analytical studies of marine and ocean deposits and Fe–Mn concretions is described. Separate abstracts were prepared for two of the articles. (tr-auth)

For abstracts of individual chapters see: 8848 and 8849.

8848 METHODS FOR THE CHEMICAL ANALYSIS OF Fe–Mn CONCRETIONS. Fomina, L. S. pp 36-93 of Khimicheskii Analiz Morskikh Osadkov. Ostroumov, E. A. (ed.). Moscow; Izdatel'stvo Nauka (1975). (In Russian)

A method was developed for the chemical analysis of iron-manganese concretions with the high precision needed for solving a number of geochemical problems on the formation of the concretions. Convenient methods for determining Mn, Fe, Tl, Co, Ni, Cu, Mo, W, Zr, Tl, Ga, Ge, As, V, Cr, rare earths, Al, Si, Ca, Mg, Ba, P, S, K, Na, and active oxygen are given. The method can also be used for the analysis of Mn and Fe ores. (tr-auth)

8849 USE OF AROMATIC SUBSTITUTED ACETIC ACIDS FOR DETERMINING AND SEPARATING METALS. Volkov, I. I.; Konnov, V. A. pp 109-157 of Khimicheskii Analiz Morskikh Osadkov. Ostroumov, E. A. (ed.). Moscow; Izdatel'stvo Nauka (1975). (In Russian)

Methods have been developed for determining Ti, Zr, and Th and separating them from Fe, Al, Mn, Ni, Co, and Zn and for determining Fe, Al, and Cr and separating them from Mn, Ni, Co, and Zn. The methods were based on precipitation at different pH values with aromatic derivatives of acetic acid–phenyl-, diphenyl-, and 1-naphthylacetic acids. The methods may be used for chemical studies of natural materials. (tr-auth)

8850 ATOMIC-ABSORPTION DETERMINATION OF STRONTIUM IN SILICATE ROCKS: A STUDY OF MAJOR ELEMENT INTERFERENCES IN THE NITROUS OXIDE ACETYLENE FLAME. Carter, D.; Regan, J. G. T.; Warren, J. (Dept. of Industry, London). Analyst; 100: No. 1195, 721-725(Oct 1975).

A study has been made of the major element interferences associated with the atomic-absorption determination of trace amounts of strontium in silicate rocks by using a nitrous oxide – acetylene flame. Aluminum causes suppression of the strontium signal, while calcium and magnesium act as partial releasing agents, thus reducing the effect of the aluminum. Exact matching of samples and standards can be avoided by the use of lanthanum, which has been shown to be an effective releasing agent in the nitrous oxide – acetylene flame. Strontium levels in the United States Geological Survey rocks AGV1, BCR1 and GSP1, in the range 244 to 670 μg g^{-1}, have been determined with a precision of better than 2%. A spiking and recovery experiment has also been carried out. Strontium can be measured in silicate rocks with a limit of determination of 0.6 μg/g. (auth)

Radiometric and Radiochemical Procedures

Refer also to abstracts 9339, 9356, 9364, 9370, 9618, and 9643.

8851 (BNWL-tr-159) RADIOACTIVE EMISSIONS FROM POWER PLANT FACILITIES FIRED WITH RHINELAND LIGNITE. Kirchner, H.; Merz, E.; Schiffers, A. Translated from Braunkohle; No. 11, 340-345(Nov 1974). 16p. Dep. NTIS $4.50.

Radiochemical measurements were made on the trace content of U and Th in Rhenanian lignite samples and their ashes. Values were found to fluctuate considerably within certain limits. Measured Th values varied from 0.4 ppM to 2.7 ppM, with an average of approximately 1.1 ppM. U varied from 0.2 ppM to rare maximum values of 1.4 ppM, with average values around 0.4 ppM. The U and Th content of ash residues was somewhat lower than expected. A rough comparison of radioactive gaseous emissions of different types of power plants is given. (JGB)

8852 (EUR-5097) MEASUREMENT OF THE WEIGHT OF STEEL IN MARTIN- AND ELECTRIC FURNACES BY MEANS OF RADIOISOTOPES. (Commission of the European Communities, Brussels (Belgium)). 1973. 41p. (In French). INIS.

3 refs.; 6 tabl.; 17 figs. Also published in German, English.

A method is described with which it is possible to determine the weights of liquid steel in electric and Martin furnaces before casting. The method, using radioisotopes, is essentially a dilution method. A known (active) quantity of radioactive Au is introduced into the furnace and when it is uniformly distributed in the liquid steel bath, a determination is made by means of activity measurements made on samples taken of the dilution undergone by the radioisotope. The quantity of steel present in the bath can be deduced from this measurement. Numerous tests have been made on electric and Martin furnaces and the optimum conditions for using this method in practice were determined. The precision with which the weight of the steel can be determined is ±1%. There is no danger in using the radioactive Au because of the very low level of the activity introduced in the furnace. (tr-INIS)

8853 (ORO-4205-1) RADIOISOTOPE X-RAY EMISSION SPECTROMETRY FOR MULTIELEMENT ANALYSIS OF AIR PARTICULATES. Final Report, June 1971-March 1975. Rhodes, J. R.; Pradzynski, A. H.; Sieberg, R. D. (Columbia Scientific Industries, Austin, Tex. (USA). Applied Research Div.). Jun 1975. Contract AT(40-1)-4205. 107p. Dep. NTIS $8.50.

Progress over the past four years to develop, apply, and establish the technique of radioisotope-excited, energy-dispersive x-ray emission spectrometry for multielement analysis of air particulates collected on filters is described. All the work has been assembled in fifteen papers or specifications which are included as appendices to this report. These appendices cover technique development (3 papers), instrumentation and applications (7), standards and interlaboratory comparisons (3) and reviews (2). The body of the report consists of a chronology of the project. (auth)

8854 (RDT-F-11-5T(5-75)) DETERMINATION OF FUEL PELLET HOMOGENEITY BY ALPHA-AUTORADIOGRAPHY. (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Reactor Research and Development). May 1975. 13p. RSO.

This standard establishes the procedure for determining the homogeneity of plutonium oxide-uranium oxide (PuO_2-UO_2) fuel pellets by alpha-autoradiography. (auth)

8855 PROBLEMS IN THE DETERMINATION OF THE SPECIFIC RADIOACTIVITY OF UNIFORMLY ^{14}C-LABELLED AMINO-

ACIDS AFTER THEIR REACTION WITH NINHYDRIN. Bishop, R.; Sims, A. P. (East Anglia Univ., Eng.). Analyst; 100: No. 1191, 369-376(Jun 1975).

Modifications to the standard Technicon amino-acid analyzer are described, which permit a reliable determination of the specific radioactivity of [U-^{14}C]-amino acids to be made after their reaction with ninhydrin. The loss of the volatile aldehyde products of the ninhydrin reaction can be prevented by trapping them with semicarbazide. Glutamate was shown to lose two carbon atoms when oxidized at pH 5.0 but only one at pH 2.5. (auth)

8856 TRACE-ELEMENT ANALYSIS OF WATER SAMPLES USING 700-keV PROTONS. Rickards, J.; Ziegler, J.F. (Instituto de Fisica, UNAM, University of Mexico, Mexico 20, D.F.). Appl. Phys. Lett. 27: No. 12, 707-709 (15 Dec 1975).

We have evaluated the trace-element sensitivity of ion-induced x-ray analysis on residues from water samples using 700-keV protons. We find that most elements of interest can be detected in quantities below one part per billion in running times of about 3 min. We discuss in detail the necessary steps for absolute calibration of the analysis system, and the process of sample preparation in countries where high-purity substrates are difficult to obtain. (auth)

8857 METHOD AND APPARATUS FOR MEASURING INCOMBUSTIBLE CONTENT OF COAL MINE DUST USING GAMMA-RAY BACKSCATTER. Armstrong, F. E. (to U.S. Energy Research and Development Administration). US Patent Application 550,099. Filed date 14 Feb 1975. 21p.

This invention describes the method and apparatus for measuring incombustible content of particulate material, particularly coal mine dust. It involves placing a sample of the particulate material in a container to define a pair of angularly oriented surfaces of the sample, directing an incident gamma-ray beam from a radiation source at one surface of the sample and detecting gamma-ray backscatter from the other surface of the sample with a radiation detector having an output operating a display to indicate incombustible content of the sample. The positioning of the source and detector along different surfaces of the sample permits the depth of the scattering volume defined by intersection of the incident beam and a detection cone from the detector to be selected such that variations in scattered radiation produced by variations in density of the sample are compensated by variations in the attenuation of the incident beam and the gamma-ray backscatter. (auth)

8858 SURFACE ANALYSIS OF LOW ENERGY ION SCATTERING SPECTROSCOPY AND SECONDARY ION MASS SPECTROSCOPY. Nelson, G. C. (Sandia Labs., Albuquerque, NM). pp 364-373 of Materials Review '75. Azusa, CA; Society for the Advancement of Material and Process Engineering (1975).

From 7th national SAMPE technical conference; Albuquerque, New Mexico, USA (14 Oct 1975). See CONF-751005-.

The surface sensitive techniques of ion scattering spectroscopy and secondary ion mass spectrometry provide information about the atomic mass of atoms present on a solid surface. The principles of these techniques are reviewed and their complementary nature is demonstrated. (auth)

8859 ACTIVATED PHOSPHORS HAVING MATRICES OF YTTRIUM-TRANSITION METAL COMPOUND. De Kalb, E. L.; Fassel, V. A. (to U. S. Energy Research and Development Administration). US Patent 3,893,939. C09k1/36. 8 Jul 1975. Filed Date 4 Jan 1973. 6p.

PAT-APPL-321,064.

A method is described for preparing a phosphor composition containing a lanthanide activator element with a host matrix having a transition element as a major component. The host matrix is composed of certain rare earth phosphates or vanadates such as YPO_4 with a portion of the rare earth replaced with one or more of the transition elements. On x-ray or other electromagnetic excitation, trace lanthanide impurities or additives within the phosphor are spectrometrically determined from their characteristic luminescence. (auth)

Separation Procedures

8860 (CEA-Bib-218(1)) SOLVENT EXTRACTION OF INDIUM, TIN, ARSENIC, AND ANTIMONY BY ORGANOPHOSPHOROUS COMPOUNDS. Auchapt, J. M.; Tostain, J. (CEA Centre de Marcoule, 30- Bagnols-sur-Ceze (France); CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France)). Nov 1975. 64p. (In French). Dep. NTIS (US Sales Only) $5.50.

All the methods concerning extraction are reviewed. As in the BIB-212(2) report they are limited to organophosphorous compounds. The latter concerned indium, titanium, tin, arsenic, and antimony. (auth)

8861 (MLM-2241, pp 26-40) SEPARATION CHEMISTRY, 11 Nov 1975.

In Mound Laboratory activities for the Division of Physical Research. Progress Report, January–June 1975. (Mound Lab., Miamisburg, Ohio (USA)).

A method of preparing nitric acid solutions of iridium by fusion of the iridium in a KOH/KNO_3 mixture followed by dissolution of the fused iridium in nitric acid is described. The method may be adaptable to the separation of plutonium from iridium and suitable for decontaminating massive iridium. Process analytical data on 30 batches of Cotter Concentrate (approximately three drums) showed recovery of about 70 g of thorium 230 with 90 percent recovery efficiency. The behavior of the bone char/water system at pH 10 is being examined, and it has been found that bone char imposes low potentials on water at about pH 10. The behavior of hexavalent plutonium with bone char at pH 10 was also examined. The removal of uranium from waste streams by contact with bone char was studied along with the mechanism which involves the reduction of uranium in solution to ultra low levels. Experimental studies were initiated wherein an adsorption isotherm, involving the ^{234}U bone char system, was measured. A total of 20.73 mg of ^{229}Th has been separated from aged ^{233}U. In addition, 1.63 mg ^{229}Th was separated from ^{233}U that has been previously processed. Processing of solutions A13-B and A13-B2 was completed through the three separation stages. The uranium was precipitated from the final solutions and calcined to the oxide. The total oxide weight of this product, designated A13-2, is 22.285 g. When all analyses have been completed and the weight of ^{234}U calculated, the product will be shipped. (auth)

8862 EXTRACTING URANIUM FROM SEAWATER. Cheng, C. S.; Huang, T. C. (Third Inst. of Oceanography, Peking). K'o Hsueh Shih Yen; No. 7, 11-13(Jul 1975). (In Chinese).

Three methods are suggested for further research in extracting uranium from seawater: precipation adsorption, ion exchange resin, and bubble separation. Titanium hydroxide is suggested as an adsorbent in precipitation adsorption. The ion exchange resin involves a chelate reaction in which there is an exchange of the uranyl ion with the resin. Acid phosphate ester is suggested as an active agent to produce bubbles for bubble separation. Research on how marine organisms, such as a kind of brown seaweed, concentrate uranium from seawater could be a promising approach. Future developments may also include constructing tidal basins with adsorption beds to extract uranium from seawater. (JPRS)

8863 AQUEOUS CHEMISTRY OF PROTACTINIUM (IV). V. Benzoylacetone Complexes of Pa(IV) and Hf(IV). Lundqvist, R. (Chalmers Tekniska Hoegskola, Goeteborg). Acta Chem. Scand., Ser. A.; 29: No. 2, 231-235(1975).

The liquid-liquid distribution systems M-HBA in C_6H_6-1 M $(Na,H)ClO_4$, where M = Pa(IV) or Hf(IV) and HBA = benzoylacetone, were studied at 25°C in the ph range 0–10. The experimental results indicated that $Pa(BA)_4$ and PaO^{2+} (or $Pa(OH)_2^{3+}$), and $Hf(BA)_4$ and HfO^{2+} (or $Hf(OH)_2^{2+}$) were the competing dominating species in aqueous phase. The extraction constants ($K_D(Pa) = [Pa(BA)_4(org)][H^+]^2[H_2O]/[PaO^{2+}][HBA(org)]^4$ or $[Pa(Ba)_4(org)][H^+]^2[H_2O]^2/[Pa(OH)_2^{3+}][HBA(org)]^4$) were found to be $\log K_D(Pa) = -0.7 \pm 0.1$ and $\log K_D(Hf) = 0.6 \pm 0.2$, for Pa(IV) and Hf(IV), respectively. The distribution constant ($\lambda_{4,-2} = [Hf(BA)_4(org)]/[Hf(BA)_4]$) for the hafnium benzoylacetone complex was determined to be $\log \lambda_{4,-2} = 3.6 \pm 0.1$. The stability constant β_4' for the aqueous reaction $HfO^{2+} + 4BA^- + 2H^+ \rightleftharpoons Hf(BA)_4 + H_2O$ (or $Hf(OH)_2^{2+} + 4BA^- + 2H^+ \rightleftharpoons Hf(BA)_4 + 2H_2O$) was calculated to be $\log \beta_4' = 41.8 \pm 0.2$. (auth)

8864 EXTRACTION OF ZIRCONIUM FROM ZIRCONIUM-CONTAINING MATERIALS. Markland, A. A. (to Danish Atomic Energy Commission). Danish Patent 128,288. 19 Aug 1974. Filed date 7 Jan 1972. 8p. (In Danish)

The method described involves the isolation of zirconium form impurities in an aqueous acid solution by extraction with an amine. The zirconium–amine compound is treated further with a view to extraction and/or conversion into another zirconium compound, principally zirconium dioxide or zirconium metal, the extraction with amine being made in the presence of hydrogen peroxide. (auth)

8865 URANIUM FROM SEAWATER. Meerestechnik; 6: No. 3, 92(Jun 1975). (In German)

A report is given on the plans of the Japanese Ministry for International Trade and Industry (MITI) for the extraction of uranium in series (coupling with heat or nuclear power plant) or tidal methods, from seawater. (GE)

8866 SORPTION OF ZIRCONIUM AND HAFNIUM ON SILICA GEL IN THE PRESENCE OF PHOSPHORIC AND PHENYLARSENIC ACIDS AND OF IODATE. Caletka, R. (Inst. of Nuclear Research, Prague). Collect. Czech. Chem. Commun.; 40: No. 10, 2941-2954 (Oct 1975).

The effect of phosphoric acid, of phenylarsenic acid (H_2L) and of iodate on the sorption of zirconium and hafnium on silica-gel from solutions of sulfuric, oxalic and hydrochloric acids and from a mixture of HCl and KSCN was studied. It has been found that the sorption increases in media in which neutral complexes are formed; the stability constants for complexes $B(HPO_4)_2$, $B(HPO_4)_3^{2-}$ and $B(L)_2$ were determined (B denotes the appropriate cation). In the presence of potassium iodate, sorption of complexes $K_nB(IO_3)_{4+n}$ is assumed. A method for the separation of zirconium and hafnium from niobium and protactinium has been developed. (auth)

8867 LOW TEMPERATURE, LOW PRESSURE HYDROGEN GETTERING. Anderson, D. R.; Courtney, R. L.; Harrah, L. A. (to U. S. Energy Research and Development Administration). US Patent 3,896,042. H01J7/18; C01B1/32. 22 Jul 1975. Filed date 15 Feb 1974. 10p.

A system is described for the gettering of hydrogen and its isotopes. The gettering materials are painted or coated onto, or otherwise disposed in an area or volume from which hydrogen is to be removed. (auth)

8868 EQUILIBRIUM CONSTANTS OF COMPLEXES U(IV) TRI-ISOOCTYLAMMONIUM SULFATE AND TRI-ISOOCTYLAMMONIUM CHLORIDE IN O-DICHLOROBENZENE. Vieux, A. S.; Rutagengwa, N. (Universite Nationale du Zaire, Kinshasa, Congo). J. Inorg. Nucl. Chem.; 37: No. 11, 2313-2314(Nov 1975).

The extraction of U(VI) from sulfuric and hydrochloric acids by solutions of tri-isooctylammonium salt in o-dichlorobenzene was studied. The equilibrium constants in this solvent for the sulfate salt of tri-isooctylamine $(R_3NH)_2SO_4$, the complex of this salt with uranyl sulfate $[(R_3NH)_2SO_4]\ UO_2SO_4]$, tri-isooctylamine hydrochloride R_3NHCl and the complex of this hydrochloride with uranyl chloride $(R_3NHCl)_2UO_2Cl_2$ are reported. The respective values of these constants are 8.22×10^{-9}, $(1.45 \pm 0.58) \times 10^{-23}$, $(1.05 \pm 0.03) \times 10^{-5}$ and $(4.80 \pm 0.53) \times 10^{-13}$. (auth)

Inorganic, Organic, and Physical Chemistry

Chemical and Physicochemical Properties

Refer also to abstracts 9216, 9762, and 10295.

8869 (MLM-2241, pp 13-14) LOW TEMPERATURE RESEARCH. 11 Nov 1975.

In Mound Laboratory activities for the Division of Physical Research. Progress Report, January–June 1975. (Mound Lab., Miamisburg, Ohio (USA)).

Several liters of e-D_2 have been made for the ortho-para D_2 vapor pressure experiments. Two new cryostats are being designed and fabricated, one for tritium studies and one for low temperature differential calorimetry. A review of the superfluid properties of ^3He has been prepared and will be published as a topical report. (auth)

8870 (MLM-2241, pp 15-25) METAL HYDRIDE RESEARCH. 11 Nov 1975.

In Mound Laboratory activities for the Division of Physical Research. Progress Report, January–June 1975. (Mound Lab., Miamisburg, Ohio (USA)).

Computer programs have been developed to calculate electronic properties of transition metals and their hydrides. The programs can be used to predict such properties as crystalline stability, electronic resistivity, Fermi surfaces, bulk moduli (or compressibilities), and hydrogen coordination of the metal atoms. Such information is of fundamental importance in understanding the electronic processes which occur in transition metals and their hydrides. Detailed calculations have been performed for Li and LiH, to test the computational integrity of the programs, and of the local density exchange approximation to the Hartree–Fock exchange. Initial work on NiH has also been performed. The proton spin-lattice relaxation times T_1 have been measured as a function of temperature and frequency for a sample of $VH_{0.53}$. The experimental values for the T_1 minimums are approximately twice as large as the minimum values calculated using the BPP model. The activation for proton diffusion in the beta-phase of VH/sub x/ is estimated to be 0.21 +- 0.01 eV. Preliminary NMR studies have been performed on $FeTiH_{1.1}$ (beta-phase) and $FeTiH_{1.7}$ (gamma-phase). The nuclear relaxation times at room temperature indicate the NMR spectra are inhomogeneously broadened and proton diffusion is not rapid enough to greatly affect either T_1 or T_2. (auth)

8871 (UCRL-50028-75-3) H-DIVISION QUARTERLY REPORT, JULY–SEPTEMBER 1975. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1975. Contract W-7405-Eng-48. 57p. Dep. NTIS $5.45.

The following are reported: shock Hugoniots of atomic iodine; electron screening corrections to the dense plasma equation of state (EOS); EOS of the Lennard–Jones fluid; test of polystyrene EOS; flexible EOS for nonionized fluids, computer code development, EOS for Ta and liquid transition metals; lateral refraction velocity in shocked iron; heat capacity, resistivity, and EOS of lead; shock compressibilities of lead and iron; tamped impulse (blowoff); impact of penetrators on armor and targets; various calculations in solid mechanics; shallow earth penetrators; simulation of combustion processes; brittle crack propagation; and spaced-charge development. (DLC)

8872 MEASUREMENT OF BINARY DIFFUSION COEFFICIENTS IN LIQUIDS UNDER HIGH PRESSURE. Schadow, E.; Steiner, R. (Technische Univ. Darmstadt (F. R. Germany). Fachbereich Physikalische Chemie und Chemische Technologie). Z. Phys. Chem. (Frankfurt); 94: No. 4-6, 223-234(Feb 1975). (In German)

6 figs.; 2 tabs.; 14 refs.

The pressure dependence of binary diffusion coefficients of organic liquids in aqueous solutions is investigated by means of a tracer method. According to the theory it can be proved that it is possible to calculate the diffusion coefficient from a characteristic parameter (time-lag) under consideration of the substance properties (density, absorption coefficient) and the geometry of the diffusion cell. The described high-pressure equipment was used to measure the binary diffusion coefficients of ^{14}C-tagged acetone, butanone-2, acetophenone and acetoaceticethylester in water at pressures up to 1,500 bars and temperatures between 30 and 60°C. (auth)

8873 NATURE OF THE REACTION PRODUCTS OF Na(I) WITH CrO_3. van Lith, H.; van Broek, E. G.; Gellings, P. J. (Technische Hogeschool Twente, Enschede, Netherlands). Inorg. Nucl. Chem. Lett.; 11: No. 12, 817-819(Dec 1975).

The x-ray diffraction patterns of the compound existing in liquid sodium in the presence of chromium and oxygen have been interpreted by some investigators as $NaCrO_2$, but as Na_2CrO_3 by others. Experimental results are presented and analyzed, and reasons are given for considering that $NaCrO_2$ is the correct formula. (UK)

8874 SPECIFIC VOLUME OF DEUTERIUM OXIDE FROM 2^0 TO 40^0C AND 0 TO 1000 BARS APPLIED PRESSURE. Emmet, R. T.; Millero, F. J. (Univ. of Miami, FL). J. Chem. Eng. Data; 20: No. 4, 351-356(Oct 1975).

Direct measurements of the specific volume of deuterium oxide (D_2O) solutions were made with a magnetic float densimeter from 2 to 40^0C and from 0 to 1000 bars applied pressure. The results were fitted to a second degree secant bulk modulus equation: $(V^0P)/(V^0 - V/sup\ p/)$ equals $A_0 + A_1P + A_2P^2 + CP^2$ where V^0 and V/sup p/ are the specific volumes at zero and P applied pressure, A_0 equals $1/beta^0$ the reciprocal of the 1 atm compressibilities, and A_1 and A_2 are temperature dependent parameters. The specific volumes were fitted to this equation with a standard deviation of 6 ppM over the entire pressure and temperature range. The equation of state of D_2O was used to compute several thermodynamic properties that are compared to the results obtained by other workers from 5 to 40^0C and 0 to 1000 bars. (auth)

Isotope Effects

Refer also to abstracts 8931 and 10274.

8875 THERMODYNAMIC FUNCTIONS AT SATURATION OF SEVERAL METAL SULFATES IN AQUEOUS SULFURIC AND DEUTEROSULFURIC ACIDS AT TEMPERATURES UP TO 350°C. Marshall, W. L. (Oak Ridge National Lab., TN). J. Inorg. Nucl. Chem.; 37: No. 10, 2155-2163(Oct 1975).

From solubilities of several metal sulfates in aqueous solutions of sulfuric and deuterosulfuric acids at temperatures up to 350°C, together with second ionization quotients (Q_2) of the acids, solubility products (Q_{sp}) were calculated. When isothermal values of log Q_{sp} in solutions of widely varying molality of acid were plotted against an extended Debye-Hückel equation, the extrapolation to zero ionic strength yielded a solubility product constant (K_{sp}). Solubilities interpreted in this manner were those for $MgSO_4 \cdot H_2O$, $NiSO_4 \cdot H_2O$, $CaSO_4 \cdot 2H_2O$, $CaSO_4 \cdot \frac{1}{2}H_2O$, $CaSO_4$, Li_2SO_4 and Na_2SO_4 in H_2SO_4–H_2O solutions and for $MgSO_4 \cdot D_2O$, $NiSO_4 \cdot D_2O$, and Li_2SO_4 in D_2SO_4–D_2O solutions. With the exceptions of $CaSO_4 \cdot 2H_2O$ and $CaSO_4 \cdot \frac{1}{2}H_2O$ studied only at 25 to 60°C and 125°C, respectively, all solubilities of salts were evaluated at temperatures from 200 to 350°C. Adherence to extended Debye-Hückel theory was good, and provided a method for calculating mean activity coefficients of the several separate salts in the acidic media. Values of log K_{sp} for each metal sulfate were plotted against 1/T (°K) to yield thermodynamic func-

tions. Similarities in behavior between the saturated $H_2SO_4-H_2O$ and $D_2SO_4-D_2O$ solutions and between Li_2SO_4 and Na_2SO_4 solubilities are described. (auth)

8876 MATRIX ISOLATION AND ISOTOPIC SUBSTITUTION TECHNIQUE: GERMANIUM ISOTOPIC SPLITTING PATTERN OF THE $\nu_3(F_2)$ MODE OF $Ge^{35}Cl_4$ AND CHLORINE ISOTOPIC SPLITTING PATTERN OF $^{74}Ge^{35}Cl_n{}^{37}Cl_{4-n}$. Koeniger, F.; Mueller, A.; Nakamoto, K. (Dortmund Univ. (F. R. Germany). Inst. fuer Chemie). Z. Naturforsch., b; 30: No. 3, 456-457(Jun 1975). (In German)

1 fig.; 1 tab.; 7 refs.

The matrix isolation spectrum of germanium tetrachloride in the region of the $\nu_3(F_2)$ vibration has been measured. Applying the isotopic substitution technique the spectrum of the normal sample could be interpreted. The frequencies of the different isotopic species have been assigned. (auth)

8877 LATTICE VIBRATION SPECTRA. XII. IR, FIR, and Raman Spectra of Alkaline Earth Metal- and Lead Halide-Monohydrates. Lutz, H. D.; Klueppel, H. J. (Gesamthochschule Siegen (F. R. Germany). Lehrstuhl fuer Anorganische Chemie). Ber. Bunsenges. Phys. Chem.; 79: No. 1, 98-104(Jan 1975). (In German)

7 figs.; 7 tabs.; 17 refs.

The IR-absorption and reflection spectra and the Raman spectra of the halogenate monohydrates: $Ba(ClO_3)_2 \times H_2O$, $Pb(ClO_3)_2 \times H_2O$, $Ca(BrO_3)_2 \times H_2O$, $Sr(BrO_3)_2 \times H_2O$, $Ba(BrO_3)_2 \times H_2O$, $Pb(BrO_3)_2 \times H_2O$, and $Ba(IO_3)_2 \times H_2O$ as well as the deuterated and partial deuterated compounds are analyzed in the range 4,000 to 30 cm^{-1} at temperatures from −160 to +190°C. The assignment of the vibrations to the species of the factor group were made by means of single crystal measurements. The large coupling of the internal vibrations of the halogenate ions causes a comparatively great factor group splitting. According to the OH stretching vibrations (or the OH force constants) and the anomalous temperature dependence of the internal vibrations of the H_2O molecules symmetric, but not linear hydrogen bridges exist in the halogenates of $Ba(ClO_3)_2 \times H_2O$ type, whose strength increases from chlorate to iodate. The hydrogen bridges of $Ca(BrO_3)_2 \times H_2O$ however are strongly asymmetric in consequence of the two OH and OD stretching vibrations of HDO in partial deuterated samples. (auth)

8878 DEUTERIUM ISOTOPE EFFECT IN CATALYTIC HYDRAZINE DECOMPOSITION AND AMMONIA SYNTHESIS. Schulz-Ekloff, G.; Baresel, D.; Gellert, W.; Sarholz, W. (Bosch (R.) G.m.b.H., Stuttgart (F. R. Germany). Technisches Zentrum Forschung); Appelt, K. (Akademia Gorniczo-Hutnicza, Poznan (Poland). Inst. of New Transformations of Energy). Ber. Bunsenges. Phys. Chem.; 79: No. 3, 263-266(Feb 1975). (In German)

4 figs.; 1 tab.; 25 refs.

The catalytic decomposition of hydrazine and deuterohydrazine at platinum was studied in sulfuric acid solution (0.25 N) at 50-90°C. The isotope effect $r^H r^D$ is 5.9 ± 0.2 at 70°C. The activation energies E^H = 29 kJ/mol and E^D = 34 kJ/mol are found from the temperature dependence of the decomposition rate. With the assumption, that the kinetics of the catalytic decomposition are limited by the splitting of a N-H bond, a maximum kinetic isotope effect was estimated, which was in good agreement with the experimental value. The deuterium isotope effect of the ammonia synthesis, formerly already measured but wrongly interpreted, was newly discussed. It was assumed that hydrazine is the adsorbed species which is in equilibrium with the formed ammonia. (auth)

8879 THE EFFECT OF REAGENT ENERGY ON CHEMICAL REACTION RATES: AN INFORMATION THEORETIC ANALYSIS. Levine, R.D. (Department of Physical Chemistry, The Hebrew University, Jerusalem, Israel); Manz, J. J. Chem. Phys. 63: No. 10, 4280-4303 (15 Nov 1975).

The effect of changing reagent vibrational and rotational energy on the reaction rate has been analyzed for over 20 chemical reactions. In most cases the selectivity in energy requirements could be characterized by a single ("consumption potential") parameter, even when the reactivity varied by many orders of magnitude. The reactions analyzed covered atom–diatom and diatom–diatom collisions and included both simple rearrangement ("exchange") reactions as well as collision induced dissociation (CID) and quenching of electronically excited states. The results were derived both from experiments and classical trajectory computations and include the variation in reactivity at both a given total collision energy and at a given translational (and rotational) temperature. In all cases the analysis was based on evaluating the surprisal of the energy consumption, i.e., the observed (or computed) reaction rate constant was compared to the rate expected on prior grounds when all states (at a given total energy) react with the same rate. The excess internal energy of the reactants is not necessarily available for reaction. Hence the consumption potential is not invariably of a definite sign. For highly endoergic processes, both experiments and trajectory computations show that often the increase in reaction rate due to reagent vibrational energy is over and above that expected on purely prior grounds (i.e., that expected due to the increase in the total available energy). The enhancement of an endoergic reaction rate by reagent vibrational energy is particularly significant for the lower vibrational states. As the excitation energy of the reagent approaches the endoergicity of the reaction, the enhancement of the rate is considerably lower. For exoergic, thermoneutral, and mildly endoergic reactions the increase in rate due to reactant vibrational energy is usually less than expected on prior (i.e., statistical) grounds. The effect of reagent rotational energy appears to be strongly correlated with the "steric requirements" of the reaction. For reactions with a preferential direction of attack (a "cone of acceptance") the enhancement in the reaction rate is often less than expected on prior grounds. The surprisal analysis demonstrates different rotational energy consumption for even and odd J states in the $F+H_2$ (v,J) reaction. Several examples of reactions with two (or more) different types of products have been analyzed. It is found that often the different reaction paths have qualitatively different energy requirements. In particular, reagent vibrational energy tends to strongly favor the most endoergic path, over and above the energetic effect expected on prior grounds. Selective excitation of reagents does provide a discriminatory (i.e., nonstatistical) method for changing the branching ratio. (auth)

8880 THE EFFECT OF INTRAMOLECULAR QUANTUM MODES ON FREE ENERGY RELATIONSHIPS FOR ELECTRON TRANSFER REACTIONS. Ulstrup, J. (Chemistry Department A, Building 207, The Technical University of Denmark, 2800 Lyngby, Denmark); Jortner, J. J. Chem. Phys. 63: No. 10, 4358-4368 (15 Nov 1975).

A general quantum mechanical description of exothermic electron transfer reactions is formulated by treating such reactions as the nonradiative decay of a "supermolecule" consisting of the electron donor, the electron acceptor, and the polar solvent. In particular, the role of the high-frequency intramolecular degrees of freedom on the free energy relationship for series of closely related reactions was investigated for various model systems involving displacement of potential energy surfaces, frequency shift, and anharmonicity effects. The free energy plots are generally found to pass through a maximum and to be asymmetric with a slower decrease in the transition probability with increasing energy of reaction. For high-frequency intramolecular modes this provides a rationalization of the experimental observation of "activationless" regions. Isotope effects are discussed as also are the oscillatory free energy relationships, predicted for low temperatures and high frequencies, and which are analogous to the vibrational structure in optical transitions. (auth)

8881 VIBRATIONAL RELAXATION IN H_2–CO AND D_2–CO MIXTURES, MEASURED VIA STIMULATED RAMAN-IR FLUORESCENCE. Matsui, H.; Resler, E.L. Jr. (School of Mechanical and Aerospace Engineering, Cornell University, Ithaca, New York 14853); Bauer, S.H. J. Chem. Phys. 63: No. 10, 4171-4176 (15 Nov 1975).

Rate constants for vibration–vibration and vibration–translation energy transfers were measured by exciting the hydrogenic species in a stimulated Raman cavity and recording the subsequent rise and decay of ir fluorescence from the admixed CO at 4.7 μm. Under the justifiable assumption that the intraspecies redistribution of vibrational energy is very rapid, the time variation of fluorescence intensities and their dependence on the sample composition can be accounted for by the following processes: $CO^{(v)}+H_2 \rightarrow CO+H_2$, $k_{C,H}=14.3\pm0.7$ $sec^{-1}\cdot torr^{-1}$; $H_2^{(v)}+H_2 \rightarrow H_2+H_2$, $k_{H,H}=4.3\pm0.1$; $D_2^{(v)}+D_2 \rightarrow D_2+D_2$, $k_{D,D}=0.9\pm0.3$; $H_2^{(v)}+CO \rightarrow H_2+CO^{(v)}$, $k^v_{H,C}=4.5\{^{+2.1}_{-1.5}$; $D_2^{(v)}+CO \rightarrow D_2+CO^{(v)}$, $k^v_{D,C}=138\pm25$. The ratio $(k^v_{H,C}/k^v_{D,C})$ is surprisingly small in view of the near resonant condition for Δv (H_2) $=-1$ coupled with Δv (CO) $=+2$. (auth)

8882 RAMAN SPECTRA OF GASES. XVIII. INTERNAL ROTATIONAL MOTIONS IN ETHYLAMINE AND ETHYLAMINE-d_2. Durig, J.R.; Li, Y.S. (Department of Chemistry, University of South Carolina, Columbia, South Carolina 29208). J. Chem. Phys. 63: No. 10, 4110-4113 (15 Nov 1975).

The Raman spectra of gaseous $CH_3CH_2NH_2$ and $CH_3CH_2ND_2$ have been recorded from 100 to 600 cm^{-1}. Both ground and excited states of the methyl and amino torsional modes for the *gauche* conformer have been observed. The overtone of the methyl torsion has also been observed for the *gauche* conformer. The methyl barriers in the *gauche* conformers of the $CH_3CH_2NH_2$ and $CH_3CH_2ND_2$ molecules were found to be 3.71±0.05 and 3.59±0.05 kcal/mole, respectively. The apparent difference in the barrier heights for these two isotopic species is attributed to a difference in the coupling between the methyl and amino torsions in these two molecules. The potential function for internal rotation around the C–N bond in $CH_3CH_2ND_2$ was determined and the following potential constants found: $V_1=279\pm16$ cm^{-1}, $V_3=707\pm4$ cm^{-1}, $V_6=-12\pm3$ cm^{-1}. The energy difference between

the potential energy minima of the *gauche* and *trans* conformations is 207 cm^{-1} (0.592 kcal/mole) with the *trans* being the more stable. The calculated *gauche-gauche* barrier is 779 cm^{-1} (2.23 kcal/mole) and the *trans-gauche* barrier is 572 cm^{-1} (1.64 kcal/mole). A similar potential function was determined for the $CH_3CH_2NH_2$ isomer but the fit to this one-dimensional model was not as good as that obtained for the deuterium compound probably because of the greater coupling in the light molecule. (auth)

8883 SPIN LATTICE RELAXATION IN AN AM{X_n} SYSTEM: APPLICATION TO ^{13}C RELAXATION IN ENRICHED MOLECULES. London, R.E.; Matwiyoff, N.A. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87544); Mueller, D.D. J. Chem. Phys. 63: No. 10, 4442-4449 (15 Nov 1975).

In ^{13}C-enriched molecules, ^{13}C–^{13}C dipolar interactions can contribute significantly to the relaxation of ^{13}C nuclei which are not directly bonded to protons. Comparison of the relaxation behavior of the ^{13}C–^{13}C multiplet lines with that of the singlet for which there are no ^{13}C–^{13}C dipolar interactions allows a quantitative analysis of this interaction. However, since ^{13}C–^{13}C dipolar interactions are necessarily weak, substantial contributions to the relaxation of nonprotonated carbon atoms are made by protons attached to adjacent atoms. The general features of the spin lattice relaxation behavior of an AM{X} system in which {X} represents the decoupled protons, A, the nonprotonated carbon, and M, the adjacent protonated carbon, have been derived. In general, the A relaxation will be nonexponential and dependent on the initial state of the M_z magnetization. A particularly useful application of these measurements on ^{13}C-enriched systems is found in their sensitivity to internal and/or anisotropic motions. Such rotations affect the ^{13}C–^{13}C and $^{13}C-{}^{1}H$ dipolar interactions differently, depending on the particular geometry involved and the axis of rotation. These techniques have been applied to the observed relaxation behavior of 6-phosphogluconate enriched to the 79% level. In this case the contributions to the intramolecular dipolar relaxation of the carboxyl carbon consist primarily of the ^{13}C–^{13}C interaction with its adjacent carbon, the $^{13}C-{}^{1}H$ interaction with the proton on the adjacent carbon, and a significant contribution from the proton attached to the third carbon in the chain. For this case, it is found that the carboxyl relaxation will be, to a very good approximation, exponential and independent of the *initial* value of M_z. Furthermore, a significantly improved fit of the data results if anisotropic rotation effects are considered. (auth)

8884 DEUTERON AND PROTON MAGNETIC RESONANCE STUDIES OF $AlCl_3{\cdot}6D_2O$ AND $AlCl_3{\cdot}6H_2O$. El Saffar, Z.M. (DePaul University, Chicago, Illinois 60614); Peterson, E.M. J. Chem. Phys. 63: No. 10, 4474-4478 (15 Nov 1975).

The angular dependence of the deuteron magnetic resonance line splittings recorded in one plane of rotation of a single crystal of $AlCl_3{\cdot}6D_2O$ have been used to establish the quadrupole coupling tensor and determine the deuteron positional coordinates. These coordinates are found to be 0.073, 0.187, 0.143; 0.202, 0.204, and 0.087. Proton relaxation times in polycrystalline $AlCl_3{\cdot}6H_2O$ have been measured as a function of temperature to evaluate the dynamic parameters associated with molecular motion. Twofold motion of H_2O with an activation energy of 10.0±0.5 kcal/mole is found to dominate the relaxation process below 385 °K. A second motion with an activation energy of 17.0±1.0 kcal/mole appears above 385 °K and is likely to be translational diffusion of the water molecules. (auth)

8885 LARGE ISOTOPE EFFECTS IN PHOTODISSOCIATION OF POLYATOMIC MOLECULES. Band, Y.B.; Freed, K.F. (The James Franck Institute and The Department of Chemistry, The University of Chicago, Chicago, Illinois 60637). J. Chem. Phys. 63: No. 10, 4479-4484 (15 Nov 1975).

The example of the photodissociation of HCN is used to demonstrate the existence of huge isotope effects in general classes of the photodissociation of polyatomic molecules. The isotopic ratio of photodissociation rates is of the form $\exp[(\mu_1^{1/2}-\mu_2^{1/2})\,K]$, where μ_1 and μ_2 are the reduced masses of the atomic fragments (different isotopes), and where K is dependent on molecule and fragment normal modes as well as upon the interfragment repulsive potential. Conditions for the maximization of K are discussed. (auth)

8886 METAL-ISOTOPE MEASUREMENTS OF IRON PENTACARBONYL. Hutchinson, B.; Hance, R.L.; Bernard, B.B.; Hoffbauer, M. (Department of Chemistry, Abilene Christian College, Abilene, Texas 79601). J. Chem. Phys. 63: No. 9, 3694-3696 (1 Nov 1975).

The infrared spectra of $^{54}Fe(CO)_5$ and natural abundant $Fe(CO)_5$ have been measured and compared in the 350 to 4000 cm^{-1} region. These measured shifts are compared to shifts calculated from three force fields. (auth)

8887 LOW-FREQUENCY VIBRATIONAL SPECTRA AND RING PUCKERING OF CYCLOPENTENE-d_8. Villarreal, J.R.; Bauman, L.E.; Laane, J. (Department of Chemistry, Texas A&M University, College Station, Texas 77843); Harris, W.C.; Bush, S.F. J. Chem. Phys. 63: No. 9, 3727-3730 (1 Nov 1975).

More than 25 ring-puckering transitions have been observed in the vapor-phase Raman and far-infrared spectra of cyclopentene-d_8. The ring-puckering potential energy function in reduced form was determined to be $V=18.20(Z^4-6.88\ Z^2)$ cm^{-1} which represents a barrier to inversion of 215 cm^{-1} (0.61 kcal/mole). The barrier differs from that of the undeuterated cyclopentene by 17 cm^{-1} owing to mixing of other motions (presumably CH_2 rockings). The equilibrium value of the molecule is calculated to have a dihedral angle of 26°. (auth)

8888 THERMOMAGNETIC TORQUE IN HYDROGEN ISOTOPES. Cramer, J.A. (Department of Physics, Texas A&M University, College Station, Texas 77843). J. Chem. Phys. 63: No. 9, 3804-3811 (1 Nov 1975).

The thermomagnetic torque has been measured in parahydrogen and ortho and normal deuterium for pressures from 0.10 to 2.0 torr and temperatures from 100 to 370 K. Since the torque depends on the precession of the molecular rotational magnetic moment around the field direction, coupling of the molecular nuclear spin to the rotational moment can affect the torque. Evidence of spin coupling effects is found for the torque in both deuterium modifications. In parahydrogen the torque at all temperatures and pressures exhibits behavior expected of a gas of zero nuclear spin molecules. Additionally, earlier data for hydrogen deuteride and for normal hydrogen from 105 to 374 K are evaluated and discussed. The high pressure limiting values of torque peak heights and positions for all these gases are compared with theory. (auth)

8889 HIGH PERFORMANCE STABILIZATION IN SUPERFLUID HELIUM. Francois, M. (Paris Univ., Orsay, France). Cryogenics; 15: No. 10, 573-576(Oct 1975).

A simple and automatic system for temperature stabilization between 1.8 and 2.2 K, with a stability of better than 10^{-6} degree, is presented. The thermometers used together in this system are a second or fourth sound cavity and a germanium resistance thermometer. An electronic servo-system allows automatic control of the whole procedure. (auth)

8890 A METHOD TO DETERMINE CRYSTALLIZATION TEMPERATURES OF HYDRATED CRYSTALS BY INTRACRYSTALLINE OXYGEN ISOTOPE EFFECTS. Heinzinger, K.; Goetz, D. (Max-Planck-Institut fuer Chemie (Otto-Hahn-Inst.), Mainz (F. R. Germany)). Earth Planet. Sci. Lett.; 27: No. 2, 219-220(Sep 1975).

The fractionation of the oxygen isotopes between water molecules from different sites in $CuSO_4 \cdot 5H_2O$ has been measured for crystallization temperatures of 25, 40, and 50°C. The temperature dependence found provides a basis for the determination of crystallization temperatures from such intracrystalline oxygen isotope effects; also for hydrated crystals of mineralogical and geological interest. Necessary suppositions for the application of this method are discussed. (NL)

8891 HEAVY ATOM KINETIC ISOTOPE EFFECTS. III. Chlorine Kinetic Isotope Effect in the Gas-Phase Unimolecular Decomposition of Ethyl Chloride. Christie, J. R.; Johnson, W. D.; Loudon, A. G.; MacColl, A.; Mruzek, M. N. (University Coll., London). J. Chem. Soc. (London), Faraday Trans., I; 71: 1937-1942(1975).

A study of $^{35}k/^{37}k$ for the gas-phase elimination of hydrogen chloride from ethyl chloride is reported. The value found at 723°K is 1.001 5 ± 0.000 2. Heavy atom kinetic isotope theory is applied in an attempt to characterize the transition state. It is concluded that there is only a moderate lengthening of the carbon–chlorine bond, and only a little motion of the chlorine atom in the transition state. (auth)

Isotope Exchange and Isotope Separation

Refer also to abstracts 9411 and 9412.

8892 (MLM-2241, pp 11-12) ISOTOPE SEPARATION. 11 Nov 1975.

In Mound Laboratory activities for the Division of Physical Research. Progress Report, January–June 1975. (Mound Lab., Miamisburg, Ohio (USA)).

Enrichment operations are reported for ^{38}Ar, ^{38}Ar, ^{13}C in methane, ^{78}Kr, ^{82}Kr, ^{83}Kr, ^{21}Ne, ^{22}Ne, ^{20}Ne, ^{124}Xe, ^{136}Xe, and ^{131}Xe. (JRD)

8893 (MLM-2241, pp 41-50) SEPARATION RESEARCH. 11 Nov 1975.

In Mound Laboratory activities for the Division of Physical Research. Progress Report, January–June 1975. (Mound Lab., Miamisburg, Ohio (USA)).

A total reflux operation was achieved in a prototype chemical exchange system for enrichment of calcium isotopes using a Karr

reciprocating-plate counter current extraction column. Sulfur 34 (natural abundance, 4.2 percent) was enriched to a concentration greater than 90 percent in a 12-column liquid thermal diffusion system. Carbon disulfide is used as the working fluid. A computer program was developed to calculate the transient performance of the dual cascade system. Total scattering cross sections for the argon-krypton scattering pair were measured. Tests are being conducted on the quadrupole detector, and performance has been improved considerably by replacing the rotating chopper wheel with a tuning fork chopper. Quantum mechanical calculations for the thermal diffusion factor of an equimolar ^3He–^4He mixture are presented for a new hybrid Morse-V/sub DD/ potential by Bruch and McGee and also for a potential derived from molecular beam scattering results. Neither of these potentials represents the 2 to 5^0K experimental results as well as the original hybrid Morse-V /sub DD/ potential by Bruch and McGee. Theoretical values of the thermal diffusion factor for ^{124}Xe–^{136}Xe were computed using a new xenon potential proposed by Barker and co-workers. These values agree with the experimentally determined values of alpha/ sub T/ for xenon better than values obtained with any other potential investigated. Also, this potential can be used to predict many other physical properties of xenon. (auth)

8894 HYDROGEN–DEUTERIUM EXCHANGE AT A SATURATED CARBON ATOM IN TERTIARY PHOSPHINE COMPLEXES OF PLATINUM(II). Kiffen, A. A.; Masters, C.; Raynand, L. (Koninklijke Shell, Amsterdam). J. Chem. Soc. (London), Dalton Trans.; No. 10, 853-857(1975).

Chloro-bridged diplatinum (II) complexes of the type $[Pt_2Cl_4L_2]$ (L = PPr_3, PBu_3, PBu^tPr_2, PBu^t_2Pr, $PPrPh_2$, PPr_2Ph, or PBu^tPh_2), undergo a regiospecific hydrogen-deuterium exchange in an aqueous (D_2O) acetic acid (CH_3CO_2D) medium to give complexes containing deuterium in the alkyl groups of the tertiary phosphine moiety and, in the case of L = PBu^tPh_2, also in the aryl groups. The steric requirements of the tertiary phosphine have a marked influence on both the rate and the position of deuterium incorporation. The results presented show that, in internal-metallation reactions of platinum, the ease of ring formation decreases in the order five-membered > six-membered > four-membered rings. It is suggested that in such reactions steric rather than electronic factors are dominant. (auth)

8895 HOMOGENEOUS PLATINUM(II)-CATALYSED HYDROGEN–DEUTERIUM EXCHANGE AT A SATURATED CARBON ATOM. Kramer, P. A.; Masters, C. (Koninklijke Shell, Amsterdam). J. Chem. Soc. (London), Dalton Trans., No. 10, 849-852 (1975).

Alkenes of the type $RC(CH_3)_2CH = CH_2$(R = Et, Pr or Bu) undergo hydrogen-deuterium exchange with a deuterium oxide-acetic ($^2H_1$) acid solvent containing perchloric acid in the presence of a homogeneous platinum(II) catalyst. Incorporation of deuterium into the alkyl part of the alkene occurs exclusively at C-5. It is suggested that exchange occurs via a dimeric platinum(II) species. Exchange of the olefine protons is also found; evidence suggests that this latter exchange is essentially an acid-catalysed reaction. Dimeric complexes of the type $[Pt_2Cl_4\{RC\text{-}(CH_3)_2CH = CH_2\}_2]$ have been isolated from the reaction medium. (auth)

8896 USE OF CARBON-13 NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY FOR DETERMINING THE POSITION OF DEUTERIUM INCORPORATION INTO SIMPLE ALKENES AND INTO TERTIARY PHOSPHINE COMPLEXES OF PLATINUM(II). Clague, D. H.; Masters, C. (Koninklijke Shell, Amsterdam). J. Chem. Soc. (London), Dalton Trans.; No. 10, 858-861(1975).

Carbon-13 nmr spectroscopy is shown to be a valuable analytical tool offering considerable advantages over other physical methods for investigating the site, and in some cases the degree, of deuterium incorporation in several simple alkenes and also in various tertiary phosphine complexes of platinum(II). ^{13}C nmr data are presented for the alkenes, $CH_2 = CHC(CH_3)_2R$(R = Et, Pr, and Bu) together with their partially deuterated analogues and also for the complexes $[M_2Cl_4L_2]$ (M = Pd or Pt; and L = PEt_3, PPr_3, PBu_3, or PBu^t_2Pr) together with the partially deuterated analogues [M = Pt and L = $PPr_3(D)$, $PBu_3(D)$, or $PBu^t_2Pr(D)$]. (auth)

8897 ENRICHMENT OF $^{14}CH_4$ BY THERMAL DIFFUSION FOR USE IN RADIOCARBON DATING. Kretner, R.; Dickel, G. (Muenchen Univ. (F. R. Germany). Physikalisch-Chemisches Inst.). Z. Naturforsch., a; 30: No. 4, 554-560(Apr 1975).

5 figs.; 3 tabs.; 17 refs.

By means of a thermal diffusion column the range of the radiocarbon dating method can be extended by about 20,000 years. In order to calculate suitable dimensions and operation conditions, a theory of nonlinear enrichment is derived. On the basis of a formula which describes the dependence of the enrichment factor on time and the characteristic values of the column, a concentric column of 11 m length was constructed. The enrichment factors obtained for $^{13}CH_4$ as a function of time (up to 400 h) and pressure (150-1,500 Torr) and for $^{14}CH_4$ at 740 Torr and up to 1,000 h are presented and discussed. A method is described to indirectly determine the enrichment factor in the stationary state and the characteristic time. (auth)

8898 SHOCK TUBE STUDIES PERTAINING TO ISOTOPIC EXCHANGE REACTIONS. I. The Self-Exchange of Carbon Monoxide. II. The Exchange of Acetylene-d_2 With Hydrogen Chloride. Bopp, A. F. New Orleans; Univ. of New Orleans (1974). 201p. University Microfilms Order No. 75-21,963.

Thesis (Ph. D.).

A complementary shock tube facility, utilizing time-of-flight (TOF) mass spectrometry and infrared emission spectroscopy as dynamic analysis methods, was employed to examine the rate of self-exchange of carbon monoxide, $^{13}C^{16}O + {}^{12}C^{18}O$ yields $^{12}C^{16}O + {}^{13}C^{18}O$, as a function of vibrational energy content. The TOF--shock tube technique was used to study the exchange of acetylene--d_2 with hydrogen chloride, $C_2D_2 + HCl$ yields $C_2HD + DCl$, and the accompanying pyrolysis of acetylene, $2C_2H_2$ yields C_4H_2. The vibrational relaxation times of CO were determined on the infrared emission shock tube in five diluents over the temperature range 1800–3000^0K. On the basis of these findings, two diluents were chosen which displayed a long and a short relaxation time for CO. This condition corresponds to low vibrational energy relative to the Boltzman limit and the fully equilibrated state, respectively. These mixtures were CO-Kr-Ar and CO-H_2-Ne. The self-exchange was studied over a temperature range 2900^0–4650^0K on the TOF system. The exchange of $C_2D_2 + HCl$ was examined from 1650^0–2600^0K on the TOF shock tube system. (Diss. Abstr. Int., B)

8899 EXCHANGE REACTION OF ACETYLENE-d_2 WITH HYDROGEN CHLORIDE. Bopp, A. F.; Kern, R. D. (Univ. of New Orleans). J. Phys. Chem.; 79: No. 24, 2579-2583(20 Nov 1975).

A mixture containing 3 percent each of the reactants C_2D_2 and HCl in an Ne–Ar diluent was studied over the temperature range 1650 to 2600^0K utilizing a shock tube coupled to a time-of-flight mass spectrometer. Plots of the mole fractions f of the exchange products, DCl and C_2HD, revealed two distinct regions of growth: (a) an initial low conversion region characterized by an induction period t/sub i/; and (b) a region of accelerated exchange during which exchange products were formed with a quadratic dependence of the reaction time. These two regions labeled a and b were combined using two empirical equations, 1 - f/sub a//f/sub eq,a/ equals exp [-k/sub a/[M]t], where t is less than or equal to t/sub i/, and 1 - f/sub b//f/sub eq,b/ equals exp [-k/sub b/[M](t - t/sub i/)^2], in order to represent the entire reaction profile at any given temperature within the interval investigated. The Arrhenius parameters for k/sub a/ and k/sub b/ were determined to be $10^{11.154\pm0.30}$ exp(-19990 +- 2850/RT) and $10^{16.404\pm0.41}$ exp(-31480 +- 4200/RT), respectively, for DCl and $10^{11.894\pm0.29}$ exp(-19150 +- 2740/RT) and $10^{15.244\pm0.34}$ exp(-17620 +- 3480/RT)for C_2HD. The units for k/sub a/ are $cm^3\ mol^{-1}\ sec^{-1}$ and $cm^3\ mol^{-1}\ sec^{-2}$ for k/sub b/. Activation energies are reported in cal mol^{-1}. Comparison with the profiles obtained for acetylene pyrolysis strongly suggests that the mechanism for the exchange is atomic. Furthermore, the exchange experiments indicate that the initial step in the pyrolysis of acetylene is the disproportionation reaction, $2C_2H_2$ yields $C_2H + C_2H_3$. (auth)

8900 HYDROGEN ISOTOPE SEPARATION FROM WATER. Jensen, R. J. (to U. S. Energy Research and Development Administration). US Patent 3,904,500. B01J1/10. 9 Sep 1975. Filed Date 17 Dec 1973. 6p.

PAT-APPL-423,367.

A process for separating tritium from tritium-containing water or deuterium enrichment from water is described. The process involves selective, laser-induced two-photon excitation and photodissociation of those water molecules containing deuterium or tritium followed by immediate reaction of the photodissociation products with a scavenger gas which does not substantially absorb the laser light. The reaction products are then separated from the undissociated water. (auth)

Feed Materials Processing

8901 (IEA-339) STUDY OF CONTINUOUS PRECIPITATION OF ADU FOR THE IMPLANTATION IN THE PILOT INSTALLATION AT THE ATOMIC ENERGY INSTITUTE, BRAZIL. de Araujo, J. A. (Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Engenharia Quimica). May 1974. 31p. (In Portuguese). INIS.

This paper deals with the ammonium diuranate continuous precipitation with a high chemical purity degree from uranyl nitrate solutions, using 1.2 and 2.4 M ammonium hydroxide solutions and gaseous NH_3 as a precipitating agent. The precipitations were carried out in a continuous procedure with one and

two stages. The variables studied were the NH_4OH solutions concentration, ADU precipitation curve, the flow rate of reactants, the temperature of the precipitation, pH of the suspended ADU and ammonium diuranate filtrability. The experimental work here performed and the data obtained permited the design of a chemical reactor for the continuous nuclear grade ADU precipitation at the Chemical Engineering Department of the Atomic Energy Institute of Sao Paulo. (INIS)

Radiation Chemistry

Refer also to abstracts 8975, 9099, 9103–9111, and 9930.

8902 (FRNC-TH-572) STUDY OF THE CONDUCTIVITY INDUCED BY RADIATIONS OF VERY DIFFERENT LINEAR ENERGY TRANSFER IN CERTAIN NONPOLAR ORGANIC LIQUIDS. Casanovas, J. (Toulouse-3 Univ., 31 (France)). 1975. 150p. (In French). INIS.

Thesis.

This study deals with ionization of some non polar dielectric liquids by radiations of very different linear energy transfers. Provided that some experimental precautions are taken the extrapolated free ion yields, $G^{(o)}_{(fi)}$, are in agreement with the clearing field ion yields. The $G^{(o)}_{(fi)}$ values are given for ten liquids irradiated by ^{60}Co γ rays and ^{210}Po α particles and the variation $G_{(fi)}$ with temperature ($10° C \leq t \leq 60°C$) and applied electric field ($0 \leq E \leq 30$ kV.cm^{-1}) are discussed. A similar study is carried out for some binary alkane-alkane and alkane electronegative compounds (CCl_4, $c\text{-}C_8F_{16}O$) mixtures. Some hypotheses are presented in order to explain the free ion yield "inhibition" in those mixtures. Using the ONSAGER theory and the high field curves, $G_{(fi)=f(E)}$, an attempt is made to determine the distribution function, F(r), of ion separation distances for each liquid. It is shown that ionization chambers filled with an alkane or an alkane-CCl_4 mixture in good proportions can be used for the dosimetry of X-rays of energy higher than 100 keV and the determination of the depth dose curve in a plexiglas phantom irradiated by the high energy electrons beams (10 MeV to 30 MeV) used in radiotherapy. (FR)

8903 (IPNO-1974, pp R1-R31) RADIOCHEMISTRY DIVISION. [nd]. (In French).

In annual report 1974.

This report is a survey of the work done in the Radiochemistry Division of the Nuclear Physics Institute in 1974: in nuclear chemistry the study of heavy ion reaction mechanisms of fusion and fission, and the search of new nuclear species; in radiochemistry the study of the physico-chemical properties of the rare-earth elements and actinides. (FR)

8904 AGGREGATION OF HOLE CENTERS IN $SrCl_2$ DOPED WITH AN ALKALI CATION. Rzepka, E.; Lefrant, S.; Taurel, L. (Paris Univ., Orsay, France). J. Phys., C (London); 8: No. 16, 2523-2531(21 Aug 1975).

Formation of aggregates of hole centres (called E centres) in $SrCl_2$: M^+ ($M^+ = Rb^+$, K^+, Na^+) by x-irradiation between 130°K and 230°K is studied. The results show that the E centre is formed from two positive hole centres, the energy of formation being 0.12 eV. The dichroism induced in the E band at 80°K ($\lambda = 263$ nm) shows that the centre has a four-fold symmetry axis. The main properties of the E centre—thermal stability (230°K), preferential orientation under optical excitation at 80°K, thermal reorientation (160°K) and photoexcitation at 5°K—are described and compared to the properties of the di-interstitial centres (V_4 centres) in KCl. The variations of the second moment of the E band in $SrCl_2$ and the V_4 band in KCl, KBr and KI are well interpreted with a higher effective frequency than the highest frequency of the lattice phonons, almost independent of the structure of the host lattice and very sensitive to the nature of the halogen ion. The analogy between the properties of the V_4 and the E centres supports the hypothesis of similar structure, these centres likely being quasi-molecular complexes. (auth)

8905 ABSORPTION IN THE FAR RED BY I_2^- AND Br_2^-. Baxendale, J. H.; Sharpe, P.; Ward, M. D. (Univ. of Manchester, Eng.). Int. J. Radiat. Phys. Chem.; 7: No. 4, 587-588(Aug 1975).

The species Br_2^- in aqueous solution shows absorption in the red with $\lambda_{max} = 730$ nm and $\xi = 340$ dm^3 mol^{-1} cm^{-1} compared with analogous I_2^- absorption $\lambda_{max} = 725$ nm and $\xi = 4.2 \times 10^3$ dm^3 mol^{-1} cm^{-1}. No far red absorption by Cl_2^- or $(CNS)_2^-$ was observed. (auth)

8906 RADIATION MECHANISMS. II. Electron Spin Resonance Studies of the Mechanism of Radiation Processes in Trivalent Phosphorus Derivatives. Fullam, B. W.; Symons, M. C. R. (Univ. of Leicester, Eng.). J. Chem. Soc. (London), Dalton Trans.; No. 10, 861-866(1975).

A range of phosphites (trimethyl and tripropyl thiophosphite, diisopropylphosphinyl chloride, diphenylphosphinyl chloride, and dithioethylphosphinyl chloride) have been exposed, either pure or in a range of solvents to ^{60}Co γ rays at 77°K. The radical products have been analyzed by esr spectroscopy. It is concluded that, after electron addition, the radical anions may protonate on phosphorus, lose an anionic ligand to give a phosphinyl radical, or lose a neutral ligand (alkyl, alkoxy, thiyl, or chlorine radicals). These radicals may subsequently add to adjacent molecules to give a range of phosphoranyl species. It is also suggested that the primary anion may sometimes rearrange to give an alkylphosphoranyl radical directly. The primary cation-radicals, $^{\cdot}PL_2^+$, react efficiently with PL_3 neighbors to give the dimer-cations, $P_2L_4^+$, but in dilute solution this is suppressed. Addition of methyl bromide suppresses anion formation and the resulting less complicated esr spectra show one of the $M_I = 0$ components (1,0) for the dimer-cations. (auth)

8907 ENDOR STUDY OF CH_2COOH RADICALS IN γ-IRRADIATED SINGLE CRYSTALS OF GLYCINE. Teslenko, V. V.; Gromovoi, Yu. S.; Krivenko, V. G. Mol. Phys.; 30: No. 2, 425-435(Aug 1975).

The CH_2COOH radicals in γ-irradiated glycine were observed in two spectroscopically inequivalent forms by the ENDOR method. The first form (A) was induced by warming γ-irradiated crystals at 77°K up to 120 to 140°K, the second one (A′) up to 140 to 300°K. The proton and nitrogen couplings are given for these two forms. The transition from A to A′ form was observed at 140 to 160°K. This transition is discussed in terms of a double-minimum potential curve for the hydrogen bond protons. The second-order effects are reduced to indirect nuclear–nuclear interaction terms giving rise to the splitting of ENDOR lines. The general expression for this interaction has been obtained. The indirect nuclear–nuclear interaction of two α-protons of CH_2COOH radicals is examined. The relative signs of proton hyperfine couplings were determined by comparison with experimental data. (auth)

8908 RADIOLYSIS OF IRON(II) PYRIDINE ISOTHIOCYANATE IN CHLORINATED SOLVENTS. McIvor, D. J.; Magee, R. J. (La Trobe Univ., Bundoora, Australia). J. Inorg. Nucl. Chem.; 37: No. 10, 2031-2034(Oct 1975).

An investigation into the γ radiolysis of iron(II) pyridineisothiocyanate was carried out in chloroform and carbon tetrachloride solvents. Yield values ($-G(Fe^{II})$) were found, and a mechanism for the radioinduced oxidation of Fe^{II} to Fe^{III} proposed. Irradiations were carried out in both aerated and deaerated environments. (auth)

8909 FORMATION OF CrO_2^{2+} IN THE OXIDATION OF CHROMIUM(II) BY MOLECULAR OXYGEN. Sellers, R. M.; Simic, M. G. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). J. Chem. Soc. (London), Chem. Commun.; No. 11, 401-402(4 Jun 1975).

Cr^{2+} reacts with molecular oxygen with a rate constant of $(1.6 \pm 0.2) \times 10^8$ l mol^{-1} s^{-1} to give a complex, CrO_2^{2+}, with λ_{max} 245 and 290 nm, $\epsilon = 7800$ and 3200 l mol^{-1} cm^{-1}, and which is long lived when $[Cr^{2+}] \ll [O_2]$. (auth)

8910 COPOLYMERIZATION OF NITROGEN CONTAINING UNSATURATED POLYESTERS WITH STYRENE UNDER THE ACTION OF γ-IRRADIATION. Valgin, A. D.; Korshak, V. V.; Kutepov, D. F.; Doskin, A. I. Plast. Massy; No. 7, 18-20(1975). (In Russian)

Physical-mechanical properties of copolymers are analyzed in terms of the effect of chemical composition of nitrogen-containing unsaturated polyesters, type of substituent at the nitrogen atom, and the irradiation dose by γ rays. Data are reported on the effect of the content of amine component in polyesters when copolymerized with styrene by the radiation method. 4 figs, 8 refs. (JPRS)

8911 BISPHENOL DERIVATE, CAPABLE OF BEING POLYMERIZED AND HARDENED, AS WELL AS THE PROCESS OF ITS PREPARATION. Flodin, P. G. M. (to Perstorp AB). Swedish Patent 364,517. 6 Jun 1974. 12p. (In Swedish)

The formula is given of a new bisphenol derivate capable of being polymerized and hardened. (LK)

8912 UV-LIGHT AND X-IRRADIATION INDUCED CONVERSION OF P-PHENOXYPHENOL IN AQUEOUS SOLUTION AT 25°C. Ehrl, A. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Biologie). Atomkernenergie; 25: No. 4, 293-302(1975). (In German)

9 figs.; 12 refs.

UV-photolysis and x-radiolysis of p-phenoxyphenol was expected to yield products analogous to those of thyronine, after aromatic structures being equivalent. When exposed to uv-light, p-phenoxyphenol was found being selectively converted into phenylhydroquinone in consequence of intramolecular rearrangement. The reac-

tion heat was estimated by applying bond energies to the conversion and comparing the result with differences in the combustion heat of homologous compounds. After x-irradiation, phenylhydroquinone however was not present. Formation of the irradiation products phenol, hydroquinone, p-benzoquinone and pyrocatechol presumed breakage of substrate molecules in consequence of intermolecular interaction with transient water radiolysis species. (auth)

8913 ESTIMATED DISTRIBUTION FUNCTIONS OF ELECTRONIC REDOX LEVELS AND THE RATE OF CHEMICAL REACTIONS OF EXCESS ELECTRONS IN DIELECTRIC LIQUIDS. Henglein, A. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany). Sektor Strahlenchemie). Ber. Bunsenges, Phys. Chem.; 79: No. 2, 129-135(Feb 1975).

2 figs.; 32 refs.

A crude estimate of the distributions of occupied and unoccupied electronic redox levels of the system s/e_{-s} and of various acceptor systems A_s/A_{-s} in n-hexane was made (e_{-s}: solvated electron; s: unoccupied solvent trap). Expressions for the rate constants of reactions of solvated and mobile electrons $e_{-(m)}$ in dielectric liquids are also given. These expressions are based on the assumption that electron reactions in solution are vertical attachment processes as in the gas phase. Some conclusions can be drawn using these expressions and the estimated distribution functions of electronic redox levels. (GE)

8914 RADIATION CROSSLINKED VINYL CHLORIDE RESIN. Nishio, K.; Sasaki, T.; Araki, K.; Fukushima, M. (to Japan Atomic Energy Research Inst.). US Patent 3,912,605. 14 Oct 1975. Priority date 26 Jul 1971, Japan. 8p.

A blended composition comprising a vinyl chloride resin and a specific epoxy compound derived from a conjugated diene homopolymer and/or copolymer can advantageously be crosslinked by means of an ionizing radiation. Said epoxy compound is bonded with an ethylenically unsaturated organic acid having a double bond adjacent the carboxyl group to a part of the epoxy group of the epoxy compound. (auth)

8915 PARAMAGNETIC DEFECTS IN IRRADIATED FERROELECTRIC $(NH_4)_2SO_4$. Bailey, C.E.; Cuesta-Barro, R.C. (Physics Department, University of Puerto Rico, Mayaguez, Puerto Rico 00708). J. Chem. Phys. 63: No. 10, 4120-4126 (15 Nov 1975).

EPR studies of x-ray damaged crystals of $(NH_4)_2SO_4$ show that long lived defects, NH_3^+ ions, are produced in two inequivalent sites with each site having two magnetically inequivalent orientations. All sites have approximately the same isotropic hyperfine splittings which are found to be 19.0 G for nitrogen and −24.6 G for hydrogen. The anisotropic components are different for the two inequivalent sites indicating different amounts of restricted rotation for the two sites. A second transient defect is identified as SO_3^-. (auth)

8916 ELECTRON–ELECTRON DOUBLE RESONANCE STUDY OF COHERENT AND RANDOM ROTATIONAL MOTION OF METHYL GROUPS. Mottley, C.; Kispert, L.D. (Chemistry Department, The University of Alabama, Tuscaloosa, Alabama 35486); Clough, S. J. Chem. Phys. 63: No. 10, 4405-4411 (15 Nov 1975).

Electron–electron double resonance (ELDOR) spectra are reported for the free radical $CH_3\dot{C}(COOH)_2$ in x-irradiated crystals of methylmalonic acid over the temperature range 10–50 K. At low temperatures tunneling sidebands are observed corresponding to simultaneous flips of the electron spin and changes in the tunneling rotation state of the methyl group. The previous assignment of weak satellite lines of the electron spin resonance (ESR) spectrum to these transitions is unequivocally confirmed, and sidebands obscured in the ESR spectrum are clearly observed in the ELDOR spectrum with the expected frequencies and intensities. The temperature dependence of the frequencies confirms the previous observation of the temperature dependence of the frequency of tunneling rotation of the methyl group. A sequence of changes with rising temperature in the relative amplitudes of lines in the ELDOR spectra is accounted for in a qualitative way as a consequence of the changing rates of several cross relaxation processes, all of which arise as a consequence of the modulation of the electron–proton hyperfine interaction by thermally activated rotation of the methyl group about its symmetry axis. (auth)

8917 LIFETIME DISTRIBUTION OF ELECTRONS IN PULSE-IRRADIATED LIQUID PROPANE. Fueki, K. (Department of Synthetic Chemistry, Faculty of Engineering, Nagoya University, Nagoya, Japan). J. Chem. Phys. 63: No. 9, 4085-4086 (1 Nov 1975).

A lifetime distribution function for geminate electrons in irradiated liquids is derived and applied to calculations of the lifetime distribution of electrons in irradiated liquid porpane. The results were compared with an experimental determination of the decay of electrons in pulse-irradiated liquid propane and agreement was satisfactory. (AIP)

8918 KINETICS OF SPUR REACTIONS OF ELECTRONS IN ETHYLENE GLYCOL--WATER GLASSY ICE. A Pulse Radiolytic Study. Barkatt, A.; Rabani, J. (Hebrew Univ., Jerusalem). J. Phys. Chem.; 79: No. 24, 2592-2597(20 Nov 1975).

Ethylene glycol–water glasses were pulse irradiated at 173°K. It was found that Cd^{2+} ions react with both trapped electrons (e^-/sub t/, k equals $(2.5 \pm 1) \times 10^5$ M^{-1} sec^{-1}) and with their precursors (k greater than 10^9 M^{-1} sec^{-1}). Cd^{2+} ions which react with e^-/sub t/ produce Cd^+ ions in the bulk of the glasses. This is demonstrated by the subsequent second-order decay of Cd^+. Cd^{2+} ions which react with the precursors of e^-/sub t/ produce Cd^+ ions in the spurs. Such Cd^+ ions decay away later by a process which is in agreement with the model of Schuler and coworkers. The fraction of Cd^+ ions which is produced in the spurs increases with $[Cd^{2+}]$ in accordance with the competition scheme e^-/sub m/ yields e^-/sub t/, $Cd^{2+} + e^-$/sub m/ yields Cd^+ where e^-/sub m/ represents a precursor of e^-/sub t/. From the effect of $[Cd^{2+}]$ on the initial e^-/sub t/ and Cd^+ absorptions, it was found that k(e^-/sub m/ yields e^-/sub t/)/k($Cd^{2+} + e^-$/sub m/) equals (0.24 ± 0.02) M. Results are also reported for the recombination of Cd^+ and the molar absorptivities of Cd^+ and similar cations in aqueous solution. (auth)

8919 TRAPPED HYDROGEN ATOM DECAY IN gamma-IRRADIATED SULFURIC ACID GLASSES AT 63 TO 90°K. Kroh, J.; Plonka, A. (Technical Univ., Wroblewskiego, Poland). J. Phys. Chem.; 79: No. 24, 2600-2602(20 Nov 1975).

No isotope effect was observed in the decay of trapped hydrogen and deuterium atoms in gamma-irradiated deuterated 6 M sulfuric acid glasses with 2-propanol added. The trapped hydrogen atoms seem to be released from the traps due to the relaxation processes proceeding in the frozen matrices. Because of that the kinetic behavior is interpreted rather as a redistribution of hydrogen atoms into more and more relaxed traps, than into deeper and deeper traps, proceeding in competition with irreversible decay in reactions with other reactive species present in the matrix. (auth)

8920 ELECTRON SPIN RESONANCE STUDIES OF gamma-IRRADIATED PHOSPHITE AND PHOSPHATE ESTERS. Identification of Phosphinyl, Phosphonyl, Phosphoranyl, and Phosphine Dimer Cation Radicals. Kerr, C. M. L.; Webster, K.; Williams, F. (Univ. of Tennessee, Knoxville). J. Phys. Chem.; 79: No. 24, 2650-2662(20 Nov 1975).

The powder ESR spectra of several gamma-irradiated phosphorus esters at 77°K were analyzed into their distinguishable radical components, each spectrum being generally a composite of anisotropic features from a number of alkyl and phosphorus-centered radicals. Resolution of overlapping spectra was achieved in some instances by radiation-chemical experiments designed to suppress or enhance the products of electron capture relative to the radicals formed by other mechanisms. The radiation chemistry of dialkyl phosphites, $(RO)_2P(O)H$, is influenced by the ease with which the P–H bond in these compounds is broken, the principal radicals being the phosphonyl species $(RO)_2PO$ and $ROP(O)O^-$. Both of these species are thought to be the secondary products of hydrogen atom abstraction by the alkyl radical R which is produced by dissociative electron capture. A similar primary step was found to apply for the trialkyl phosphates, $(RO)_3PO$, but in this case only carbon-centered radicals are formed by secondary H-atom abstraction processes. Results for the pyrophosphite differ from those for the trialkyl phosphites in showing the absence of alkyl radicals or their phosphoranyl adducts and the formation of the phosphonyl species $(EtO)_2PO$, the latter being produced presumably by cleavage of the P–O–P bridge. The ESR parameters for each of the four main groups of phosphorus-centered radicals are summarized and the electronic structures of these radicals are discussed briefly. (auth)

8921 ELECTRON SPIN RESONANCE STUDIES OF gamma-IRRADIATED PHOSPHORUS COMPOUNDS CONTAINING PHOSPHORUS–CHLORINE BONDS. Kerr, C. M. L.; Webster, K.; Williams, F. (Univ. of Tennessee, Knoxville). J. Phys. Chem.; 79: No. 24, 2663-2668(20 Nov 1975).

ESR experiments similar to those described in the preceding paper were used to identify the radicals produced in a series of gamma-irradiated phosphorus compounds containing phosphorus–chlorine bonds. The principal species formed from diethyl chlorophosphite are the neutral radicals $P(OEt)_2$ and $(EtO)_2PCl_2$ presumably by loss and addition of chlorine atoms, although there is evidence that the former species is produced at least in part by dissociative electron capture. On the other hand, the major radical derived from a series of chlorophosphate esters is invariably the chlorophosphoranyl radical anion formed by simple electron attachment to the parent molecule. In the dichlorophosphoranyl radicals, there is a large ^{35}Cl coupling from the two equivalent chlorines in the apical positions of a trigonal bipyramidal structure. Evidence for the anisotropy of this coupling suggests that a significant spin density resides in the 3p/sub sigma/ orbitals of these chlorine ligands, in agreement with recent single crystal studies on $POCl_3^-$. The much greater stability of radical anions

derived from chlorophosphates relative to those from di- and trialkyl phosphate esters, which undergo efficient dissociation, is interpreted in terms of the effect of ligand electronegativity on the spin density distribution. This effect is consistent with recent MO descriptions which indicate that the half-occupied orbital in phosphoranyl radicals is largely localized along the axial three-center bond. (auth)

8922 ELECTRON SPIN RESONANCE STUDIES OF METHYL RADICALS TRAPPED ON 4A TYPE ZEOLITE. Shiotani, M.; Yuasa, F.; Sohma, J. (Hokkaido Univ., Sapporo). J. Phys. Chem.; 79: No. 24, 2669-2674(20 Nov 1975).

Three kinds of methyl radicals were observed with different heat treatments of Linde 4A type zeolite. The first is the normal methyl radical; the second is the abnormal methyl radical, type I, having additional coupling with one extra proton; and the third is the abnormal methyl radical, type II, having large coupling with one of the three protons. These three different radicals are stabilized on the zeolite heat treated at ca. 65, ca. 80, and ca. 250°C, respectively. It was revealed by experiments using CD_4 that a hydrogen atom liberated from irradiated CH_4 is most probably stabilized on the zeolite surface and converted into H^+, which causes the additional coupling noted in the abnormal methyl radical I. The fact that the ^{13}C-hyperfine coupling of the abnormal methyl radical, type II, gives axial symmetric tensors and shows a trend of A/sub parallel/ (75.8 G) greater than A/sub perpendicular to/ (10.5 G) indicates that this methyl radical interacts with the surface through a 2P/sub pi/ unpaired-spin orbital and rotates about the C_3 symmetry axis. The relation of each type of methyl radical with the trapping environment as well as the probable geometry of each radical is discussed. (auth)

8923 ELECTRON SPIN RESONANCE AND PULSE RADIOLYSIS STUDIES OF SOME REACTIONS OF $SO_4^{\cdot-}$. Chawla, O. P.; Fassenden, W. (Carnegie-Mellon Univ., Pittsburgh). J. Phys. Chem.; 79: No. 24, 2693-2700(20 Nov 1975).

The in-situ photolysis of aqueous solutions of peroxydisulfate ($S_2O_8^{2-}$) was investigated as a source of radicals for ESR studies. This initiating system was found to be quite effective in that the $SO_4^{\cdot-}$ so produced reacts readily with a variety of solutes; successful detection of a number of new radicals was possible. Attention was focused mainly on radicals resulting from reaction of $SO_4^{\cdot-}$ with inorganic ions. Direct observations were made where possible, and spin trapping with CH_2 double bond NO_2^- or fumarate was used in other cases. Radicals directly observed include $CO_2^{\cdot-}$ from formate, $CO_3^{\cdot-}$ from bicarbonate, HO_2 from H_2O_2, and H_2NO from NH_2OH. The g factor of $CO_2^{\cdot-}$ was found to be 2.00045 and the line width 2.3 G. No change in parameters was found over the pH range 0.8 to 4.6. The radical $CO_3^{\cdot-}$ with g equals 2.0113 and line width 4.4 G is reported for the first time in aqueous solution. No changes in the spectrum which might give evidence for the pK of this radical were found over the pH range 7.5 to 11.9. The pK for the dissociation PO_3H^- reversible $H^+ + PO_3^{2-}$ was determined to be 5.9. Evidence for reaction of $SO_4^{\cdot-}$ with NH_3, CN^-, $H_2PO_4^-$, and Cl^- was obtained by trapping the resultant radicals which are believed to be NH_2, CN, PO_4^{2-}., and $Cl_2^{\cdot-}$., respectively. Pulse radiolysis studies confirm the formation of $Cl_2^{\cdot-}$ from Cl^- (k/sub $SO_4^{\cdot-} + Cl^-$/ equals 3.1×10^8 M^{-1} sec^{-1}) by means of its absorption spectrum. Thus the reaction $SO_4^{\cdot-} + Cl^-$ can be used to provide a source of $Cl_2^{\cdot-}$ in neutral and basic solutions. Conductometric pulse radiolysis studies were carried out on several organic unsaturated compounds to clarify the nature of the $SO_4^{\cdot-}$ reaction. It was concluded that $SO_4^{\cdot-}$ adds to the simple olefins cyclohexene and allyl alcohol while a direct oxidation of benzene to hydroxycyclohexadienyl radical occurs in the time scale of less than 10 mu sec. (auth)

8924 PULSE RADIOLYSIS OF AQUEOUS LITHIUM CHLORIDE SOLUTIONS. Woods, R. J. (CEN de Saclay, Gif-sur-Yvette, France); Ferradini, C.; Pucheault, J. J. Phys. Chem.; 79: No. 24, 2700-2704(20 Nov 1975).

The formation of $Cl_2^{\cdot-}$ by pulse radiolysis and its subsequent disappearance, in the presence and absence of N_2O, were studied with neutral LiCl solutions of concentrations up to 14 M. In deaerated solutions, the yield with respect to the total absorbed dose shows a maximum at about 9 M, where $G(Cl_2^{\cdot-})$ equals 3.4, and decreases at higher concentrations. This would seem to indicate that the direct effect on the Cl^- ions gives rise to almost no $Cl_2^{\cdot-}$, while the yield of primary species responsible for its formation (H_2O radiolysis) would appear to be about 4.7. (auth)

8925 CRYSTALLINITY AND THE EFFECT OF IONIZING RADIATION IN POLYETHYLENE. I. Crosslinking and the Crystal Core. Patel, G. N.; Keller, A.; (Bristol Univ., Eng.). J. Polym. Sci., Polym. Phys. Ed.; 13: No. 2, 303-321(Feb 1975).

An extensive study has been carried out on the effect of ionizing radiation on polyethylene in the form of solution-grown single crystals to follow up preceding investigations which had indicated that the radiation-induced effects along the fold surfaces could be significantly different from those within the crystal interior. In this first part of the series, radiation-induced crosslinking was investigated in the case of "crystal core" material. This material, obtained by removal of the fold surface by oxidative degradation with ozone, consists of isolated foldfree crystal layers of dicarboxylic acids of uniform length, the length itself depending on the fold length of the starting crystal. This "core material" was irradiated by gamma rays and the effect of crosslinking was followed by GPC analysis by recording the development of dimer, trimer, etc., peaks in the chromatograms. For a given dose, the fractional amount of crosslinked material is independent of the chain length. This, together with other effects described, provides unambiguous evidence that crosslinking occurs at the chain ends or, in other words, that there is no crosslinking within the interior of the paraffinoid lattice. Further, no permanent scission was observed to occur within the lattice, at least in amounts detectable by the present molecular weight measurements. The obvious significance of these effects for radiation studies on paraffinoid substances in general, beyond those of the present long-chain dicarboxylic acids, is discussed prior to utilizing them in the study of chain-folded polyethylene crystals in the following parts of the series. (auth)

8926 CRYSTALLINITY AND THE EFFECT OF IONIZING RADIATION IN POLYETHYLENE. II. Crosslinking in Chain-Folded Single Crystals. Patel, G. N.; Keller, A. (Bristol Univ., Eng.). J. Polym. Sci., Polym. Phys. Ed.; 13: No. 2, 323-331(Feb 1975).

In order to ascertain whether the crystal core of irradiated polyethylene single crystals is free from crosslinks the fold surface of irradiated single crystals was shaved off with ozone and the resulting product examined by GPC for molecular weight. It was found that on ozone degradation the entire material, which had been insolubilized by radiation-induced crosslinking, has become soluble and hence beacme available for the GPC analysis. The chromatograms displayed the same peaked development with degradation as the unirradiated crystals leading eventually to single traverse dicarboxylic acids. This proves the absence of crosslinks within the crystal interior of the material as examined by GPC. The appearance of some additional low molecular weight material is attributed to scission at the radiation-induced double bonds due to ozone which eliminates the possibility of the existence of crosslinks within the lattice such as might provide scission sites for ozone. The conclusion could therefore be reached that, to the extent assessable by our GPC test, there are no radiation-induced crosslinks within the crystal lattice, hence the crosslinks produced must be entirely confined to the fold surface region of the crystals. (auth)

8927 CRYSTALLINITY AND THE EFFECT OF IONIZING RADIATION IN POLYETHYLENE. III. An Experiment on the Irradiation-induced Crosslinking in n-Hexatriacontane. Patel, G. N.; Keller, A. (Bristol Univ., Eng.). J. Polym. Sci., Polym. Phys. Ed.; 13: No. 2, 333-338(Feb 1975).

Samples of n-hexatriacontane irradiated in the crystalline and molten states were compared as regards the GPC chromatograms of the partially crosslinked products. From differences in the elution volumes it could be inferred that there is a greater trend for random linking along the chain in the sample irradiated in the melt as opposed to preference for end-type linking in the samples irradiated as crystals. In the course of this work the applicability of the GPC technique for detecting short (methyl) branches and for distinguishing between the position of these branches along the chain has also become apparent. (auth)

8928 CRYSTALLINITY AND THE EFFECT OF IONIZING RADIATION IN POLYETHYLENE. IV. Effect of Segregation of Low Molecular Weight Chains on Determination of Main-Chain Scission in Linear Polyethylene. Patel, G. N. (Bristol Univ., Eng.). J. Polym. Sci., Polym. Phys. Ed.; 13: No. 2, 339-350 (Feb 1975).

Different single crystal preparations of polyethylene with (unfractionated) and without (partially fractionated) low molecular weight chains were irradiated at room temperature. G(crosslink) was determined from the gel point. It is shown that in addition to the molecular weight and molecular weight distribution of polymers, G(crosslink) is determined by three more parameters: thickness of crystalline core, amount of amorphous surface layer, and degree of interlamellar contact. Unlike unfractionated polyethylene, partially fractionated polyethylene showed almost 100 percent gel at about 250 Mrad. To obtain the same amount of gel, unfractionated polyethylene required a much higher dose than that required by partially fractionated polyethylene. Molecular weight distribution of sol fractions of unfractionated and partially fractionated polyethylene was studied by gel permeation chromatogra-

phy (GPC) and the solubility data analyzed by Charlesby-Pinner plots. It has been shown that the unattainability of 100 percent gel from unfractionated polyethylene is due to segregation of low molecular weight chains during crystallization which need very high doses for complete gelation. (auth)

8929 CRYSTALLINITY AND THE EFFECT OF IONIZING RADIATION IN POLYETHYLENE. V. Distribution of Trans-Vinylene and Trans,Trans Conjugated Double Bonds in Linear Polyethylene. Patel, G. N. (Bristol Univ., Eng.). J. Polym. Sci., Polym. Phys. Ed.; 13: No. 2, 351-359(Feb 1975).

Freeze-dried chain folded single crystals and the single crystals without amorphous surface layers (crystalline cores) of different thicknesses of linear polyethylene were irradiated with ^{60}Co gamma-rays up to 600 Mrad. Concentration of trans-vinylene double bonds and conjugated diene produced during irradiation of the crystals was measured by infrared. Concentrations of trans-vinylene and of the conjugated diene were independent of thickness of crystalline core which suggest that the double bonds were randomly distributed in the crystalline parts of the crystals. Concentrations of trans-vinylene and of conjugated double bonds were lower in chain-folded crystals than in the crystalline cores and this suggests that the folds (amorphous surface layers) are less preferential sites for formation of the double bonds. The zero-order growth and first-order decay kinetics of trans-vinylene double bonds was studied by the equation derived by Dole et al. The equation is strictly obeyed up to 300 Mrad and the results then deviate. Since there is the decay of trans-vinylene double bonds and though there are no crosslinks in the crystalline cores, it has been suggested that the decay of the double bond does not result in the crosslinks. (auth)

8930 CRYSTALLINITY AND THE EFFECT OF IONIZING RADIATION IN POLYETHYLENE. VI. Decay of Vinyl Groups. Patel, G. N. (Bristol Univ., Eng.). J. Polym. Sci., Polym. Phys. Ed.; 13: No. 2, 361-367(Feb 1975).

Freeze-dried single crystals of unfractionated Marlex 6009 polyethylene were irradiated at various doses up to 100 Mrad. Analysis of the data of the present work and those of others showed that the decay of vinyl groups can be best described by second-order kinetics. The decay rate constant is found to increase with decrease in original concentration of vinyl groups. It has been concluded that the increase in the decay rate constant with decrease in initial vinyl concentration is due to a decrease in crystallinity. Some supporting evidence has been presented for this conclusion. (auth)

8931 RADIATION PROCESSES FOR TRICHLOROMETHYL COMPOUNDS: THE CCl_3 RADICAL. Mishra, S. P.; Symons, M. C. R. (Univ. of Leicester, Eng.). Int. J. Radiat. Phys. Chem.; 7: No. 5, 617-625(Sep 1975).

A range of compounds containing the trichloromethyl group have been exposed to ^{60}Co γ-rays at 77°K, either in the pure state or in various solutions. The resulting ESR spectra have been analyzed both at 77°K and during annealing. Carbon tetrachloride in CD_3OD gave a well-defined spectrum of $\dot{C}Cl_3$ together with satellite lines for $^{13}\dot{C}Cl_3$. Chloroform gave equal concentrations of $\dot{C}Cl_3$ and $H\dot{C}Cl_2$ in the pure state, but $\dot{C}Cl_3$ was only formed during annealing for solutions in CD_3OD. 1,1,1-Trichloroethanol gave a high yield of HCO radicals at 77 K, together with $\dot{C}Cl_3$ and a radical thought to be $\dot{C}H_2OH$. 1,1,1-Trichloroacetone gave mainly $Cl_2\dot{C}-CO-CH_3$ and $H_2\dot{C}-CO-CCl_3$. 1,1,1-Trichloroethane gave $Cl_2\dot{C}-CH_3$ and possibly $Cl_2C-\dot{C}H_2$ in the pure state, and $Cl_2\dot{C}-CH_3$ only in CD_3OD. (auth)

8932 YIELDS OF EXCITED SINGLET STATE IN THE RADIOLYSIS OF ALKANE CONTAINING TOLUENE IN THE SOLID PHASE AT 77°K. Miyazaki, T.; Tanaka, T.; Kuri, Z. I. (Nagaya Univ., Japan). Int. J. Radiat. Phys. Chem.; 7: No. 5, 627-634 (Sep 1975).

When alkane containing a small amount of toluene is γ-irradiated in the solid phase at 77°K, excited toluene is formed by energy transfer from irradiated alkane to toluene. Fluorescence from excited singlet toluene has been measured during γ-irradiation and after nanosecond pulse irradiation. Yields of the excited singlet toluene (S) have been determined for the first time in the solid phase at 77°K and the following G-values were measured: G(S) = 0.8 to 0.9, 0.7, and 0.7 in the radiolysis of cyclohexane, 2,3-dimethylbutane and 3-methylpentane containing toluene (0.2 mol dm^{-3}), respectively. The rate constants for energy migration, obtained experimentally from the kinetics, are of the same order of magnitude as those calculated by the theory of exciton migration. (auth)

8933 HIGH-INTENSITY RADIOLYSIS OF WATER. I. Formation of Hydrogen Peroxide in Deaerated Acidic Solutions. Muller, J. C. (Laboratoire Curie, Paris); Ferradini, C.; Pucheault, J. Int. J. Radiat. Phys. Chem.; 7: No. 5, 635-641(Sep 1975). (In French).

For an intensity of 5×10^{27} eV $g^{-1}s^{-1}$ the yield of hydrogen peroxide formed in deaerated sulfuric acid solutions has been measured: $G(H_2O_2) = 0.70$. It is concluded that at high intensities of irradiation there is complete overlapping of the heterogeneous zones of radicals which are believed to be formed in the initial stage of irradiation. In these conditions the value adopted for $G\text{-}H_2O$ is 4.6. (auth)

8934 FORMATION AND PROPERTIES OF THE TRIVALENT NICKEL-ETHYLENE DIAMINETETRAACETIC ACID (EDTA) COMPLEX IN AQUEOUS SOLUTIONS: A PULSE-RADIOLYTIC STUDY. Lati, J. (Ben-Gurion Univ. of the Negev, Beersheba, Israel); Meyerstein, D. Int. J. Radiat. Phys. Chem.; 7: No. 5, 611-616(Sep 1975).

Ni(II) EDTA is oxidized by OH radicals to an unstable Ni(III) EDTA complex with a rate of 2.3×10^9 dm^3 mol^{-1} s^{-1}. The trivalent complex formed undergoes a rearrangement reaction to a relatively stable form of Ni(III) EDTA with a rate constant of 2.0×10^3 s^{-1}. The spectra of both forms of Ni(III) EDTA have maxima at 288 nm. Ni(III) EDTA reacts with O_2 and I^- with rates k = 6.5×10^2 dm^3 mol^{-1} s^{-1} and 1.25×10^3 dm^3 mol^{-1} s^{-1} respectively. The redox potential of the couple Ni(II) EDTA/Ni(III) EDTA is estimated as $0.54 \leq E^0 \leq 1.06$ V. The mechanisms of the reactions involved are discussed. (auth)

8935 ELECTRON SPIN RESONANCE STUDIES OF OXAMIC ACID SINGLE CRYSTALS X-IRRADIATED AT 77°K. Finchh, L. L.; Hampton, D. A.; Moulton, G. C. (Florida State Univ., Tallahassee). J. Magn. Resonance; 18: No. 2, 248-253(May 1975).

When single crystals of oxamic acid are irradiated at 77 K, at least three radical species are trapped at that temperature: an intense broad singlet that is identified as the anion radical, a very weak doublet identified as a radical pair, and another radical that is probably the cation radical or its decay product. When the crystal is warmed to room temperature, the ESR spectra change. Two singlets with very similar g tensors but different eigenvectors are observed at room temperature. The two singlets are probably produced at the different ends of the molecules by loss of water and ammonia, respectively. (auth)

8936 OBSERVATION OF A CHEMICAL REACTION REVERSIBLY TRIGGERED BY A STRUCTURAL PHASE TRANSITION. Lamotte, B. (CEN, Grenoble, France). Solid State Commun.; 17: No. 7, 811-816(1 Oct 1975).

Two distinct radical species, $(AsO_4)^{4-}$ and $(AsO_3)^{2-}$, created by gamma irradiation in crystals of $ND_4D_2AsO_4$, undergo (taking into account the deuterons) the following chemical reaction: $AsO_3D^- + OD^- \rightleftharpoons AsO_4D_2^{2-}$. The effect occurs at the antiferroelectric-paraelectric phase transition of the compound. Its essential feature is that the reaction is completely reversible i.e., that it can be triggered by the phase transition, the direction of the reaction depending on the direction of passage of the Curie point. An analogy is presented with a biological process, namely the second step of the co-operative binding of oxygen on haemoglobin. (auth)

8937 DEMONSTRATION BY ESR OF RADICAL TRANSFORMATION AT THE PARA TO FERROELECTRIC PHASE TRANSITION OF IRRADIATED KH_2AsO_4 CRYSTAL. Gaillard, J.; Gloux, P. (CEN, Grenoble, France). Solid State Commun.; 17: No. 7, 817-822(1 Oct 1975). (In French).

Reversible transformations of free radicals have been observed by EPR at the para-ferroelectric phase transition in X- or gamma-irradiated crystals of potassium dihydrogen arsenate. In particular, the existence of a transformation of a radical of type AsO_4^{3-} into a radical of type AsO_4^{4-} suggests that these two radical families result from a common cause during irradiation, namely the capture of an electron on the original AsO_4^{3-} tetrahedron. (auth)

8938 HIGH-INTENSITY RADIOLYSIS OF WATER. II. Capture of OH Radicals in Deaerated Acidic Solutions. Muller, J. C. (Laboratoire Curie, Paris); Ferradini, C.; Pucheault, J. Int. J. Radiat. Phys. Chem.; 7: No. 5, 643-650(Sep 1975). (In French).

The oxidation of Fe^{II} to Fe^{III} and of As^{III} to As^{IV} with simultaneous production of H_2O_2, has been studied as a function of concentration for a high intensity of irradiation delivered in a pulse of accelerated electrons. The work confirms the conclusions reached in the preceding paper [Muller et al., Int. J. Radiat. Phys. Chem. 7:635 (1975)], in particular that concerning a significant overlapping of the heterogeneous zones. (auth)

8939 MECHANISM OF THE RADIOLYTIC DECOMPOSITION OF NITROUS OXIDE IN LIQUID CYCLOHEXANE. Busi, F.

(Consiglio Nazional delle Ricerche, Bologna); Flamigni, L.; Roda, A. Int. J. Radiat. Phys. Chem.; 7: No. 5, 589-596(Sep 1975).

In the radiolysis of cyclohexane + HCl solutions, $g(H_2)$ (where g means the yield due to the energy absorbed in the solvent only) is concentration dependent up to a plateau value of 7.1 ± 0.10. The sum of $G'(N_2) + g(H_2)$ from cyclohexane + N_2O solutions follows the same curve as $g(H_2)$ from cyclohexane + HCl solutions. In the radiolysis of cyclohexane + N_2O solutions the yields of cyclohexane and bicyclohexyl increase with scavenger concentration ultimately reaching plateaux at 3.7 and 2.45, respectively. The presence of HCl in cyclohexane increases the yields of bicyclohexyl with a scavenger concentration dependence identical with that obtained in the presence of nitrous oxide. The analysis of the oxygen containing products formed in the radiolytic decomposition of N_2O in cyclohexane gives water and cyclohexanol as the only detectable products. The sum of the yields of the two oxygen-containing products is equal to the nitrogen yields over the whole concentration range examined indicating that no secondary reactions contribute to N_2 formation. Assuming that the radiolysis of HCl solutions and N_2O solutions forms H_2 and N_2, respectively, via the same ionic processes a g(total ionization) = 5.3 ± 0.1 is calculated for liquid cyclohexane. (auth)

8940 FREE RADICALS IN γ-IRRADIATED SINGLE CRYSTALS OF UNSATURATED NITRILES. Muszkat, L. (Weizmann Inst. of Science, Rehovoth, Israel). Int. J. Radiat. Phys. Chem.; 7: No. 5, 597-602(Sep 1975).

The free radicals N = CR—CH = CH—CH = CH—CN and N = C—CH—CH—CH—CH_2CN were respectively observed in γ-irradiated single crystals of 2,4-trans, trans-hexadiene-1,6-dinitrile and of 3-hexene-1,6-dinitrile. (auth)

8941 γ-RADIOLYSIS OF LIQUID ACETONE, METHYL, ETHYL, KETONE, AND DIETHYL KETONE. Akhtar, S. M. S.; Woods, R. J.; Bardwell, J. A. E. (Saskatchewan Univ., Saskatoon, Canada). Int. J. Radiat. Phys. Chem.; 7: No. 5, 603-610(Sep 1975).

The liquid phase radiolyses of acetone, methyl ketone and diethyl ketone were investigated and detailed analysis of gaseous and liquid products were carried out. The effect of absorbed dose on product yield was examined. The results indicate that the formation of most of the products involve similar reactions for all three ketones, although an intramolecular rearrangement is suggested for ketones having β-hydrogen atoms. E. S. R. spectra are reported for the polycrystalline ketones irradiated at low temperature. (auth)

8942 RADIOLYSIS OF CYCLIC FLUOROCARBONS. III. F-alicyclics at Elevated Temperatures. Bloch, F. W.; MacKenzie, D. R. (Brookhaven National Lab., Upton, NY). Int. J. Radiat. Phys. Chem.; 7: No. 5, 651-660(Sep 1975).

The following alicyclic fluorocarbons have been irradiated at 450°C with ^{60}Co γ-rays: perfluoro-cyclobutane (C_4F_8), perfluoro-cyclohexane (C_6F_{12}), perfluoro-bicyclohexyl ($C_{12}F_{22}$), perfluoro-decalin ($C_{10}F_{18}$), perfluoro-tetradecahydro phenanthrene ($C_{14}F_{24}$), and perfluoro-hexadecahydro fluoranthene ($C_{16}F_{26}$). G-values for decomposition ranged from 2.5 to 9 molecules/100 eV for all compounds but one, indicating a high degree of radiolytic stability at 450°C for alicyclic fluorocarbons generally. The one highly unstable compound, perfluoro-bicyclohexyl, decomposed with an apparent G-value of over 10^5, but this drastic breakdown was caused largely by a high rate of thermal decomposition. Parallel pyrolysis experiments and experiments with chlorine scavenger yielded data which enable reasonable mechanisms to be deduced for both pyrolysis and radiolysis of several of the other compounds. (auth)

8943 ABSORBED DOSE DISTRIBUTION IN A PULSE RADIOLYSIS OPTICAL CELL. Miller, A.; McLaughlin, W. L. (Danish Atomic Energy Commission, Risoe). Int. J. Radiat. Phys. Chem.; 7: No. 5, 661-666(Sep 1975).

When a liquid solution in an optical cell is irradiated by an intense pulsed electron beam it may be important in the chemical analysis of the solution to know the distribution of energy deposited throughout the cell. For the present work, absorbed dose distributions were measured by thin radiochromic dye film dosimeters placed at various depths in a quartz glass pulse radiolysis cell. The cell was irradiated with 30 ns pulses from a field-emission electron accelerator having a broad spectrum with a maximum energy of ≈ 2 MeV. The measured three-dimensional dose distributions showed sharp gradients in dose at the largest penetration depths in the cell and at the extreme lateral edges of the cell interior near the optical windows. This method of measurement was convenient because of the high spatial resolution capability of the detector and the linearity and absence of dose-rate dependence of its response. (auth)

8944 ISOTHERMAL LUMINESCENCE AND THERMOLUMINESCENCE OF GAMMA-IRRADIATED POLYETHYLENE AT 77°K. George, T.; Randle, K. J. (Royal Military Coll. of Science, Shrivenham, Eng.). J. Phys., D (London); 8: No. 13, 1585-1594(11 Sep 1975).

An investigation is made of the isothermal luminescence (ITL) and thermoluminescence (TL) from low-density polyethylene which has been γ-irradiated at 77°K. From a comparison of the decay of ITL from samples receiving doses varying from a few kilorads to a megarad, it is concluded that the decay kinetics are basically of first order but with a distribution of rate constants. The influence of post-irradiation annealing at 77°K on the subsequent TL glow curves has also been investigated. It is concluded that ITL at 77°K is a thermally activated process rather than one relying on electron tunnelling. (auth)

8945 RADIOLYSIS OF HYDROGEN SULFIDE IN THE PRESENCE OF BUTADIENE-1,3, AND CARBON TETRACHLORIDE. Szamrej, I.; Jowko, A.; Fprys, M. (Univ. Teachers Coll., Siedlce, Poland). Radiat. Eff.; 25: No. 3, 191-195(1975).

The γ-radiolysis of hydrogen sulfide in the presence of butadiene and carbon tetrachloride was studied. Addition of butadiene causes the slow diminishing in $G(H_2)$ and sharp lowering in G(S) from 7.1 for pure H_2S down to 0.8 at all the used concentrations of butadiene. When carbon tetrachloride is added to hydrogen sulfide, $G(H_2)$ is not changed but G(S) increases by $\Delta G(S) \approx 2$. The presence of butadiene and carbon tetrachloride together causes the same change in $G(H_2)$ as in the case of butadiene alone and lowers G(S) to zero. The ionic mechanism of molecular sulfur formation is proposed, consistent with the observed experimental facts. (auth)

8946 RADIATION-INDUCED DEGRADATION OF SOME CRYSTALLINE AMINO ACIDS. Gejvall, T.; Loefroth, G. (Univ. of Stockholm). Radiat. Eff.; 25: No. 3, 187-190(1975).

The gamma-radiation induced degradation of five crystalline DL-amino acids, leucine, isoleucine, norleucine, valine, and norvaline, has been quantitatively studied. The major products are carboxylic acids formed by deamination of the amino acids, ammonia, amines formed by decarboxylation of the amino acids, and carbon dioxide. In addition, carbonyl compounds and amides, plus small amounts of hydrogen gas and various hydrocarbons have been detected. The total degradation, (–M), has been determined (by isotope dilution) to be 8 for valine and 14 for leucine. (auth)

8947 METHODS FOR REDUCING THE INFECTION HAZARD OF WASTE-WATER SLUDGE. Farrell, J. B.; Stern, G. (National Environmental Research Center, Cincinnati). pp 19-28 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

The most commonly used disposal practices for digested sewage sludge in the United States of America are disposal to landfill, agricultural use, incineration and disposal to the ocean. About a quarter of the sludge produced is used for agricultural purposes. The US Congress has been strongly urging more beneficial use of waste-water and waster-water sludge. However, plant location and other considerations, such as the high metals content of many sludges, make it unlikely that the proportion of sludge used on the land will increase markedly in the near future. A portion of the sludge used on the land must be attenuated in content of infectious material below that obtained by conventional digestion processes. One method for reducing infection hazard is high-energy irradiation. However, this method must compete with other methods such as pasteurization, long-term lagooning, thermophilic anaerobic digestion and thermophilic aerobic digestion. The high-energy irradiation method offers several advantages, particularly high reliability, but its cost must be competitive with other methods to gain acceptance. (auth)

8948 CURRENT TECHNOLOGY AND ADVANCES IN TRUE RE-USE OF EFFLUENTS. Cillie, G. G. (National Inst. for Water Research, Pretoria). pp 29-43 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Increasing exploitation of natural water resources has necessitated true reuse of effluents. Such planned reuse is preferable to the indirect or incidental reuse which has hitherto been practiced, sometimes indiscriminately. Modern technology provides the means for renovating effluents to any desired quality standard, including human consumption. The major obstacles still confronting widespread application of true reuse are the removal of nitrogen compounds and trace organic residues, including insecticides, herbicides and carcinogens. The need to guarantee hygienic quality

by removal or destruction of all pathogens, including viruses and parasites, constitutes a major cost item. Radiation techniques may well be applied for sterilization and for destruction of organic radicals. A combination of various unit processes, for which design criteria and hardware are readily available, can be used to produce potable water at a cost of some 10 cents/m^3 for a 45 Ml/d plant. (auth)

8949 RADIATION TREATMENT OF WASTES: A REVIEW. Feates, F. S.; George, D. (Atomic Energy Research Establishment, Harwell, Eng.). pp 61-72 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Since 1945 over 70 papers have been published on various applications of radiation to waste treatment. Work carried out up to 1970 showed consistently that radiation is effective in degrading organic matters in wastes, destroying pathogenic organisms, and enhancing the sedimentation and filterability of sludges, but at a cost about ten times that of conventional treatment methods. Increased cost of energy, scarcity of potable water, environmental awareness and consequent legislation, and technical developments may be changing the picture. For example, ozone, already being widely used as an alternative to chlorine for sterilization, is claimed to be produced by gamma-irradiation of air or oxygen at half the cost of electrical methods. Radiation may solve specific problems associated with industrial wastes and evidence is reported of synergistic effects with oxygen and chlorine. In-situ reactivation of carbon used as an absorbent for textile dye wastes has been observed, and is being further studied. Prototype plant for complete sterilization of sewage sludge for use as fertilizer is in operation. Safety precautions necessary if large radiation sources are used by nontechnical operatives will also be considered. (auth)

8950 NEED FOR THE USE OF HIGH-LEVEL RADIATION IN WATER TREATMENT AND IN WASTE-WATER (SEWAGE) TREATMENT. Nielson, N. E. (Aqueonics, Inc., Los Altos, CA). pp 73-82 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

After excellent conventional primary, followed by the best possible conventional aerobic secondary and then chemical disinfection, significant quantities of contaminants are still present in sewage, especially pathogenic organisms and toxic or toxicity-causing long-chain-molecular forms. These contaminants are generally encountered in waste-waters with a seldom predictable, almost totally random frequency. Many of these chemical forms enter reuse situations where they can become toxic to man, or to wildlife, even in concentrations of a few parts per thousand million. It has been amply demonstrated that the long-held contention is no longer valid that dilution of these contaminants to an innocuous level is easily attained by their release into large bodies of water such as lakes, oceans and rivers. At the same time, a great deal of energy is required when using known techniques in highly reliable systems for removing or rendering innocuous a large portion of these contaminants. In the light of this new (to some people) information describing a much larger, more complex set of conditions which must be considered in effective water pollution elimination, high-level radiation becomes very attractive. There is a great need for high-level radiation in water treatment or waste-water treatment where the ultimate goal is a safe, non-environmentally degrading, safely reusable quality of water. Gamma radiation, used under the right circumstances, is the most reliable, most cost-effective, most generally efficient technique in the tertiary stages. With the addition of select chemicals to increase the number of ionizations realized and/or to capitalize upon surface charge phenomena, its effectiveness can be even further expanded. (auth)

8951 DISINFECTION OF SLUDGE AND WASTE-WATER BY IRRADIATION WITH ELECTRONS OF LOW ACCELERATING VOLTAGE. Holl, P. (Polymer-Physik GmbH and Co. KG, Tuebingen, Ger.); Schneider, H. pp 123-138 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

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From the point of view of hygiene, sewage sludge and water accumulating in ever increasing quantities, some of which is used in agriculture, represent a potential threat to the health of man and beast, as well as to the environment. It is known that these chains of infection can be broken up by ionizing radiation. The use of natural ionizing radiation or electron radiation with high accelerating voltage has not been accepted in practice because the radiation cannot be cut off and the investment cost for electron accelerators with an accelerating voltage of more than 1 MV is very high. These disadvantages may be overcome by using an electron accelerator with low accelerating voltage. Complex experiments have shown that it is not necessary to adapt the thickness of sewage sludge or water layer to the range of electrons. The layer to be irradiated may be much thicker if the substrate is revolved during irradiation. The advantages of this method are low accelerating voltage for the electrons and hence less costly radiation shielding, complete absorption of the radiated energy by the substrate, and low investment and operating cost. The sterilizing effect of the process can be explained by the secondary reactions that take place in the water, in addition to the primary reactions, when irradiating with high specific ionizing density. It is known from experiments carried out by Muenzner that water irradiated with electrons of high specific ionization density, when added to bacterial cultures, will destroy them. This is explained by the Weiss radical theory of water, with reaction products such as H_2, O_2 and H_2O_2. The success of this process is shown by experiments with Escherichia coli, tap water to which Salmonella senftenberg were added, and by the content of Enterobacteriaceae in various sludges as a function of the irradiation period, as well as by the rate at which various invariable species of strongilide larvae, eggs of Ascaris suum, Fasciola hepatica and oocysts of Eimeria spec. of poultry are reduced. Details are given on the improved sedimentation behavior of the sludges. (auth)

8952 BIOLOGICAL EFFECTS OF HIGH-ENERGY ELECTRON IRRADIATION OF MUNICIPAL SLUDGE. Sinskey, A. J.; Shah, D.; Wright, K. A.; Merrill, E. W.; Sommer, S.; Trump, J. G. (Massachusetts Inst. of Tech., Cambridge). pp 139-149 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Since 1 May 1974, studies at M.I.T. on electron irradiation of municipal waste-water and sludge have been advanced by NSF support under RANN project GI-43112. All irradiations have been performed at the High Voltage Research Laboratory using a compressed gas-insulated 4-MeV Van de Graaff electron accelerator. This source was operated on simulated or actual sewage materials at 3 MV for most of the studies. The irradiated quantities per assay ranged from 20 to 1000 ml and the dosage from 10^4 rad to 3×10^6 rad. The selection of doses depended on the sensitivity of the organisms and effects under study. Treatment times were mostly close to 1 s, the electron beam current being controlled to deliver the desired dosages in this time. Radiobiological measurements were first carried out on three typical water-borne bacteria and one bacteriophage. Conditions of irradiation were varied from the anoxic state to atmospheric air, atmospheric oxygen and oxygen up to 15 atmospheres pressure. Later studies were made on coliform and total count reduction in municipal sludge. The studies showed that inactivation of bacteria and viruses in phosphate buffer and in sewage sludge can be obtained by electron irradiation. A dosage of 300,000 rad was sufficient to produce a 99.99% kill in the total population present in sewage sludge. The coliforms and other Gram negative organisms in sludge proved to be the most susceptible to radiation. 100% inactivation of these bacteria was obtained with total dosages of less than 150,000 rad. (auth)

8953 TREATMENT OF SEWAGE SLUDGE WITH COMBINATIONS OF HEAT AND IONIZING RADIATION (THERMORADIATION). Sivinski, H. D. (Sandia Labs., Albuquerque, NM). pp 151-167 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Research on the application of a combined heat and ionizing radiation treatment to sewage sludge is described. This treatment can be optimized to maximize synergistic biological inactivation of pathogens such as bacteria, viruses and parasites. The enhancement of desirable chemical and physical effects resulting from this treatment is also being studied. (auth)

8954 SYNERGISTIC EFFECTS OF IRRADIATION OF WASTE-WATER. Woodridge, D. D. (Florida Inst. of Tech., Melbourne); Cooper, P. C.; Van den Berg, A. J.; Musselman, H. D.; Lowe, H. N. pp 169-189 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Water is an absolute necessity for all forms of animal and plant life. As man's requirements for water increase, the need for better methods of purification also increase. Technology has been slow to develop new methods of water treatment for the direct utilization of waste-water. Many new construction projects are at a standstill because waste-water treatment methods have not been developed to handle adequately the ever-increasing flow of sewage. Theoretical considerations of the use of high-level radiation in the treatment of waste-water have failed to consider the effects of the hydrated electron, and the potential of the possible synergistic effects of combining chlorine, oxygen and irradiation. An extensive testing program at the University Center for Pollution Research of the Florida Institute of Technology over the past four years has shown that irradiation of waste-water samples immersed in an aqueous environment provide bacterial kill and reduction in organic pollution far greater than that obtained from theoretical considerations of G values and earlier experiments where the waste samples were not immersed in an aqueous environment. These testing programs have investigated the synergistic effects of combining oxygen and irradiation. Each of these combined treatments resulted in an increased bacterial kill factor. Tests on Staphylococcus aureus bacteria and faecal streptococcus bacteria indicate that the synergistic effects observed for faecal coliform bacteria also apply to the pathogenic bacteria. A statistical analysis of the data obtained shows the relationships between the various effects on the bacteria. A definite shielding factor from the turbidity of the waste-water has been shown to exist. Synergistic effects have been shown to offset significantly the shielding effects. Optimization of these synergistic effects can greatly increase the effectiveness of irradiation in the treatment of waste-water. (auth)

8955 GAMMA IRRADIATION FOR SEWAGE TREATMENT AT US ARMY FACILITIES. Van den Berg, A. J. (Army Facilities Engineering Support Agency, Fort Belvoir, VA); Hollis, H. D.; Musselman, H. D.; Lowe, H. N.; Woodbridge, D. D. pp 191-196 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

The US Army Corps of Engineers has been sponsoring research for many years on the use of gamma irradiation for disinfection and sterilization of sewage plant effluents. Initial research was directed to laboratory experiments using sterile solutions to determine the effects of gamma irradiation on E. coli, M-pyogenes and M-smegmatis organisms, and on the chemical constituents of sewage such as phenols, surfactants and pesticides. The results of the initial research warranted further study using municipal sewage secondary effluent as test samples. Current research is directed towards investigating the effects of radiation on the constituents of sewage sludge and on the cyst stage of the amoebic protozoa. Consideration has been given by the Corps to the management of waste-waters by disposal on land. Legal and medical reasons dictate that the plant effluents be sterilized before being used as fertilizers and soil conditioners. Gamma radiation from isotopic sources appears to be the best source of sterilizing energy for Army waste-water disposal. The Corps of Engineers is considering the construction of an experimental gamma irradiation pilot facility to validate laboratory experimental work and to establish design criteria for operating plants. The data obtained will provide a basis for performing detailed cost effectiveness studies on gamma irradiation as a method to treat secondary plant effluent. In addition, optimization work will be conducted to determine where in the sewage treatment cycle the use of gamma irradiation will produce the best results in meeting current and anticipated standards. (auth)

8956 SCOPE FOR UTILIZING GAMMA RADIATION FOR MICROBIOLOGICAL CONTROL OF SEWAGE WASTE-WATER IN INDIA. Lewis, N. F. (Bhabha Atomic Research Center, Bombay). pp 197-202 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Conventional methods, including the activated sludge process, the trickling filter process and oxidation pond process, of treating sewage waste in India, do not adequately ensure safe utilization of the secondary effluent for land irrigation purposes. Preliminary findings indicate that gamma radiation in the range of 0.1 to 0.3 Mrad effectively destroys pathogens in the secondary effluent, thereby making available very large quantities of water for land irrigation and industrial purposes. (auth)

8957 DATA ON THE DISINFECTION OF LIQUID MANURE BY GAMMA IRRADIATION AT BAJA, HUNGARY. Simon, J.; Tamasi, G. (Univ. of Veterinary Sciences, Budapest). pp 209-216 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

At Baja in southern Hungary there is a large state farm producing 100,000 swine yearly. The amount of liquid manure produced by the farm daily totals 800 to 1000 m^3. The aim of the present investigation was to determine those radiation doses which are completely lethal to microbes that cause various food infections, so that we could provide a liquid manure with a satisfactory microbiological condition and that this sludge, and also the separated water, could be used agriculturally, as up to now the application of this product to vineyards and orchards has been prohibited. The irradiation of samples was carried out with a NORATOM-type gamma-cell equipment with a ^{60}Co source. The dose rate was 228.2 rad/s, and the activity about 9000 Ci at the time of our experiments. The results showed that the aeration of liquid manure, i.e. filling with oxygen, did not influence the effectiveness of the radiosterilization procedure. We agree therefore with the literature that states that anaerobic bacteria are more radioresistant than aerobic bacteria. In this respect, spores play a subsidiary role, because the vegetative Clostridia are much more resistant than the aerobic spores. It seems reassuring that to destroy Salmonellae a relatively low dose of 0.4 Mrad is sufficient. It is not, however, useful to sterilize Mycobacteria by gamma radiation. No great differences have been observed in the radiosensitivity of the aerobic and anaerobic microbes. The authors point out that by means of radiosterilization the liquid manure becomes a harmless product from the microbiological point of view. Disinfection of liquid manure by gamma irradiation enables it to be reused for its nutritive value. (auth)

8958 AQUEOUS RADIATION CHEMISTRY IN RELATION TO WASTE TREATMENT: AN INTRODUCTORY REVIEW. Hoigne, J. (Swiss Federal Inst. of Tech., Zurich). pp 219-232 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

The ionization and excitation of water by high-energy irradiation leads to the formation of hydroxyl and hydrogen radicals, and solvated electrons. In the absence of very high concentrations of solutes the radiation chemical reactions are mainly due to indirect effects of these intermediates. The yield of these species is well known. The sum of the yields amounts to about 6 millimoles per kg per Mrad. Depending on the pH and the concentration of oxygen and dissolved substances in water, the primary species may be transformed to species such as O_2^- ($HO_2^\cdot$) and organic radicals which may react to peroxy intermediates. The solutes compete with each other for the reactive intermediates. For known concentration ratios and irradiation intensities the dominant reactions occurring may be estimated by applying the kinetic data which are well established and available in catalogues for solvated electrons, $OH^\cdot$ and $H^\cdot$ radicals. Kinetic data for species such as O_2^- are less known but these species are expected to play a minor role. The solutes that have reacted with the primary species may decompose, react with each other or be oxidized by oxygen. During the irradiation process, the reaction system may drastically change from an aerobic to an anaerobic system. The occurrence of irradiation-induced chain reactions, such as autoxidations, can only be expected in very special circumstances which are unlikely to occur in an actual waste-water. Possible exceptions are discussed. Particles that are dispersed in a waste-water can only compete with molecularly dissolved molecules for reaction with radiolytic intermediates, if their rate of reaction or their concentration is many orders of magnitude higher than that of the dissolved reactive molecules. The reagents produced by the radiation are too expensive to solve any chemical transformation of wastes, except when favorable secondary conditions, e.g. for flocculations or biological effects, occur. On the other hand, the knowledge of reaction kinetics accumulated by radiation chemists for aqueous systems gives a useful background for further progress in using other chemical treatments for the removal of impurities in waste-water. (auth)

8959 RADIATION CHEMICAL DESTRUCTION OF PHENOL IN OXYGENATED AQUEOUS SOLUTIONS. Micic, O. I.; Nenadovic, M. T.; Markovic, V. M. (Boris Kidric Inst. of Nuclear Sciences, Belgrade). pp 233-239 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

The mechanism of phenol degradation in irradiated aqueous solutions has been studied. The irradiations were carried out in a ^{60}Co gamma source. The technique of pulse radiolysis (Febetron 707) and kinetic absorption spectrophotometry were used to identify transient species. For the dose rate higher than 10 krad · h^{-1} the phenol degradation yield, G(-phenol), remains constant in the range of phenol concentrations between $5 \cdot 10^{-3}$ and $5 \cdot 10^{-2}$M. Below 10 krad · h^{-1}, G(-phenol) depends on the dose rate, phenol concentration and the presence of oxygen in solution. Under these conditions chain reactions of phenol degradation take place. As a consequence of this, G(-phenol) increases by one or two orders of magnitude. Pulse radiolysis studies show that the phenol peroxy radical formed in irradiated solution is very unstable, and decays rapidly by the first order reaction $C_6H_5OH(OH)O_2 \rightarrow C_6H_4(OH)_2 + HO_2$. The phenol peroxy radical does not initiate chain reactions. It is the O_2^- radical that reacts with phenol as a first step in the autodegradation chain. This reaction of the hydroperoxy radical is thermodynamically unfavorable and other additives, particularly inorganic ions, suppress it. Organic compounds probably have no significant influence on reaction yield. Special attention has been paid to determine the conditions under which G(-phenol) is constant and high. A comprehensive mechanism is presented together with the absolute rate constants for the various radical reactions involved. (auth)

8960 EFFECTS OF GAMMA RADIATION FROM ^{60}Co ON DILUTE AQUEOUS SOLUTIONS OF LINEAR ALKYL SULFONATE SURFACTANTS AND OTHER ORGANIC POLLUTANTS. Rohrer, D. M. (Florida Inst. of Tech., Melbourne). pp 241-248 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

This study is the result of research findings and operational experiences gained by the author in over four years of work associated with the use of ^{60}Co for the treatment of waste-water. The effects of ^{60}Co are discussed with regard to radiochemical destruction of specific organic pollutant species. The study deals specifically with the effects of gamma radiation from a 30,000 Ci ^{60}Co source upon aqueous solutions of Linear Alkyl Sulfonate Surfactants. The new Linear Alkyl Sulfonate (LAS) Surfactants, the major surfactant produced in the United States of America since June 1965, was developed to replace the old Alkyl Benzene Sulfonate (ABS) Surfactants. The reason for the removal of Alkyl Benzene Sulfonate Surfactants was their extreme environmental stability and the associated appearance of foam in waste-water treatment plants and receiving streams. Although the Linear Alkyl Sulfonate Surfactants are considered "bio-degradable", the time required for "bio-degradation" is impractical within the present environmental guidelines. This led to research into alternate techniques of treatment for the destruction of Linear Alkyl Sulfonate Surfactants. Consideration is also given to similar effects of gamma radiation upon pesticides and to the practical aspects of the use of gamma radiation for the treatment of waste-water. Included are discussions of the general experimental procedures used, the sources and their calibration, and sampling techniques to ensure the accuracy of the data. (auth)

8961 EFFECTS OF GAMMA IRRADIATION ON THE DEGRADATION OF DYES. Piccinini, N.; Ferrero, F. (Politecnico di Torino, Turin). pp 249-264 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

To investigate the degradation kinetics of aqueous solutions of dyes of several classes, we studied the effects of gamma irradiation versus the dose (up to 80 krad), the dye concentration, the pH and the oxygen content of these solutions. To study the influence of some of the above-mentioned parameters, anthraquinonic dyes have been irradiated in a wide range of doses (up to 5 Mrad). Furthermore these dyes were acted upon in order to investigate the complex reactions of molecular alteration through chromatographic separations and spectrophotometric analyses. Experimental results agreed with a first order kinetics for dye concentrations lower than 0.04 g/l, and with a zero order one for higher concentrations. The pH was found to have a different influence according to the type of dye; for example we found that the degradation efficiency for anthraquinonic dyes has higher values for basic ranges. The dissolved oxygen supports the degradation in comparison with deaerated solutions, though its influence varies according to the dye type and the pH. The oxygen action is particularly evident with high doses; in fact, tests on anthraquinonic dyes with doses up to 5 Mrad showed a marked decrease in the kinetic constants caused by the oxygen disappearance. Radiochemical degradation yields (G_d), never greater than a few units, show that the radical reactions responsible for the decolorization effect, are limited to a few transfer sequences. COD decrease, on the other hand, confirms the presence of oxidation phenomena which correspond to computed radiochemical yields (G_{ox}) markedly higher than those spectrophotometrically measured; such a difference is enhanced in the case of irradiation with aeration of solutions. The theoretical considerations are also described that were developed for outlining a general scheme involving the experimental results of both the kinetics and the radiochemical yield. (auth)

8962 POSSIBLE USE OF HIGH-LEVEL RADIATION FOR THE DEGRADATION OF SOME SUBSTANCES PRESENT IN URBAN AND INDUSTRIAL WATERS. Cappadona, C.; Guarino, P.; Calderaro, E.; Petruso, S.; Ardica, S. (Univ. of Palermo, Italy). pp 265-284 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Tests on representative solutions or suspensions of organic solvents, dyes, pesticides and chlorophenols have been performed to investigate their behavior after treatment with gamma radiation under static and aerated dynamic systems. In most cases a notable degradation of these substances was found related to the pH, oxygenation and composition of the medium and to the mixture of commercial products. (auth)

8963 DEGRADATION OF PERSISTENT ORGANOCHLORINE POLLUTANTS BY GAMMA RADIATION AND ITS POSSIBLE USE FOR WASTE-WATER TREATMENT. Vollner, L.; Rohleder, H.; Korte, F. (Institut fuer Oekologische Chemie der Gesellschaft fuer Strahlen- und Umweltforschung, Munich). pp 285-296 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Some organochlorine pesticides, polychlorinated biphenyls and related chemicals have become ubiquitous pollutants by their persistence and are common contaminants in waste-waters. Since gamma radiation represents a possible treatment for decontamination, radiation yield and degradation chemistry were investigated. The results of these investigations may be summarized as follows: (1) The pattern of hexane extractable compounds obtained from acetone-water and from pure water solutions are not very different when compared by GC-analysis; (2) no distinct main degradation product was detectable in any of the solute-solvent systems investigated, but a number of compounds were formed simultaneously; (3) dechlorination and dehydrochlorination were found to be the most important mechanisms of the first attack; (4) the complete destruction of chlorine pesticides and of other chlorinated hydrocarbons (as PCBs) at the ppM level demand considerable radiation doses. G-values for dieldrin and its hexane extractable degradation products are 1×10^{-3} in deionized water and 3.6×10^{-5} in twice-distilled water. G-values for aldrin, lindane, chlordane and PCBs range in the same order of magnitude. The costs for an irradiation waste-water treatment are estimated with three main assumptions: (1) pure gamma radiation from ^{60}Co offers the most attractive irradiation treatment; (2) high-level ^{60}Co sources cost about 2 DM/curie; (3) a dose of 1 Mrad would be sufficient. With some minor additional assumptions, a treatment price of 10 DM/m^3 waste-water results. This figure is more than three times higher than the highest one that has been reported in a study on the real actual costs for complete waste-water treatment plants in 20 German factories from 10 different branches of industry. Although the obstacle of costs seems insurmountable at present, irradiation treatment methods deserve further interest for three reasons: (1) irradiation offers the possibility of complete degradation of any organic pollutant; (2) the radiation yields may be improved with increasing knowledge in radiation chemistry; (3) the relation between irradiation and conventional treatment costs may change. (auth)

8964 COMPARISON OF THE CHEMICAL EFFECTS OF OZONE AND OF IRRADIATION ON ORGANIC IMPURITIES IN WATER. Hoigne, J. (Swiss Federal Inst. of Tech., Zurich). pp 297-305 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Depending on the reaction conditions, radiation and ozone yield the same reactive intermediates in aqueous oxygenated solutions. In both systems the OH· radical can become the main species for

the oxidation of organic impurities. The oxidizing intermediate produced by ozone has been identified by comparing its reaction selectivities with those known for the $OH^{\cdot}$ radicals initiated by high-energy irradiation. The conditions have been investigated (pH-range and solutes) for which the predecomposition of ozone to $OH^{\cdot}$ radicals becomes effective before ozone reacts directly with dissolved solutes. Because many moles of $OH^{\cdot}$ radicals are necessary to eliminate one mole of an organic solute by oxidation (TOC-reduction), the cost of the oxidizing agent is a determining factor for a cost/benefit evaluation. The yield of $OH^{\cdot}$ radicals per decomposed ozone is about 0.5 when compared with a radiation chemical yield of $G(OH^{\cdot}) = 2.9$. The $OH^{\cdot}$ radicals initiated by ozone in alkaline aqueous solutions cost 1 to 2 orders of magnitude less than those produced by gamma radiation. Therefore, other potential advantages of radiation would have to bear a large part of the cost, if radiation is to be competitive with ozone to eliminate dissolved impurities in water. (auth)

8965 WASTE-WATER AND SLUDGE RE-USE PROJECT BY GAMMA IRRADIATION AT KECSKEMET, HUNGARY: SOME APPROACHES AND INVESTIGATIONS. Simon, J.; Gacs, F.; Urban, A. (Sanitary Epidemiological Inst., Budapest). pp 411-417 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Preliminary bacteriological and parasitological results of the scheme for sterilization of waste-water at Kecskemét, Hungary, by varying gamma irradiation doses, are presented. (auth)

8966 PILOT PLANT EXPERIENCE IN THE TREATMENT OF INDUSTRIAL AND MUNICIPAL WASTE-WATER BY MEANS OF RADIATION-INDUCED OXIDATION. Hay, W. C. (International Purification Systems, Inc., Atlanta). pp 433-446 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Gamma-radiation-induced oxidation of organics adsorbed on activated carbon was studied for more than a year in a pilot plant having a design flow rate of 5000 gallons daily of waste effluents with organic concentrations of 100 ppM. Oxygen requirements, methods of injecting the oxygen and the economics involved for the process are presented. COD and BOD reduction, as well as color and odor elimination, are shown to be directly related to the quantity of oxygen dissolved in the waste-water and the radiation dose. Greater than 90% reduction in COD was regularly accomplished during continuous large-scale runs. Dissolved oxygen in the plant feed is consumed in this process, and the carbon dioxide yield is measured in the effluent. More than 99% of the coliform bacteria present are killed. Other bacteria kills range from 95% upward. This study confirmed a new process for in-situ reactivation of charcoal by gamma-induced oxidation which is both highly efficient and economically favorable. A new method of injecting oxygen into the waste-water was developed using air as the oxygen source. This method is capable of producing oxygen concentrations of 11.5 mg/l in industrial and municipal effluents used as pilot plant feed. At this level of dissolved oxygen the process efficiency appears to reach its peak. The primary object of this work was to reduce COD, BOD and bacteria concentration in effluents to a level acceptable for discharge into navigable waters. It was found, however, at high dissolved oxygen levels in the feed, the process yields a water product suitable for recycle. Hence recycle became a prime object and accomplishment. The economics of this method of waste-water treatment were found to be highly favorable, substantially lower in cost than other methods of obtaining comparable results. (auth)

8967 EFFECTS OF GAMMA RADIATION AT PILOT PLANT LEVEL COMPARED WITH THE EFFECTS OF PASTEURIZATION ON THE DEWATERING OF SEWAGE SLUDGES. Groneman, A. F. (Association EURATOM-ITAL, Wageningen, Netherlands). pp 491-502 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Dewatering and disposal of sludge are costly and time consuming processes. At a pilot plant near Munich efforts were made to estimate the effects of ionizing radiation on dewatering characteristics of different sludges, used for recycling in agriculture. The ease with which sludge drains on drying beds and in mechanical devices is reflected in the value of the specific resistance to filtration. A dose of 300 krad, delivered at an average dose rate of 62 krad per hour in the irradiation plant, was effective for disinfection and reduced the specific resistance to filtration in sludges from the waste-water works at Geiselbullach and Starnberg from 24.2×10^9 s^2/g and 18.0×10^9 s^2/g to 9.7×10^9 s^2/g and 5.6×10^9 s^2/g, respectively. These improved dewatering properties were associated with a clear increase in the compressibility of the anaerobically digested sludges. Pasteurization at 70°C during 30 minutes drastically reduced the dewatering properties, raising the specific resistance to values approximately four times as high as the specific resistance in irradiated sludges. Information obtained from filterability tests was confirmed by plant operators who noticed that irradiated sludges dewatered much better than untreated sludges in drying beds. Experimental evidence indicated that the conditioning effect of gamma irradiation persisted for more than 20 days suggesting that permanent changes were induced in the physical-chemical properties of the domestic, anaerobically digested sludges. Measurements of electrophoretic mobilities showed that the negative electrostatic charges of colloidal particles in sludges were reduced by gamma irradiation whereas pasteurization increased this negative electrostatic charge. Evidence indicated that the specific resistance was considerably increased by effects of the recirculating pumping. This pumping is done to obtain a homogeneous irradiation dose for disinfection. Alternative designs for irradiation plants are suggested, which may also ensure a sufficiently homogeneous irradiation dose but without the adverse effects of excessive pumping. (auth)

8968 EXPERIENCE WITH A PILOT PLANT FOR THE IRRADIATION OF SEWAGE SLUDGE: ANALYTICAL STUDIES ON SEWAGE SLUDGE. Rosopulo, A.; Fiedler, I.; Staerk, H.; Suess, A. (Bayerische Landesanstalt fuer Bodenkultur und Pflanzenbav, Munich). pp 535-551 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Analysis of mineral nutrients and trace elements in sewage sludge over a one year period showed that there are relatively small differences in the content of inorganic constituents. In relation to sewage sludge treatment we found a change in the ratio of NH_4-N : total after a heat treatment; this means that the ammonium content increased in 70% of the analyzed samples compared with untreated sludge. After radiation treatment of sewage sludge no changes can be observed up to a pH of 8. With an increase of the pH value (≥ 8), losses of NH_4-N can be observed. During the dewatering process of sewage sludge—which is influenced by sewage sludge treatment—potassium, sodium and ammonium are enriched in the filtering water. While there is a decrease in these alkali elements in the dewatered sewage sludge, almost no change can be observed in the other components. In a study of the availability of mineral compounds and trace elements to plants, results are presented of inorganic nutrients and essential or toxic trace elements of sewage sludge and plants. (auth)

8969 POTENTIAL OF RADIATION STERILIZATION IN SOLID WASTE TREATMENT: A STATUS REPORT. Padova, R.; Lapidot, M.; Molco, M.; Ross, I. (Soreq Nuclear Research Centre, Yavne, Israel). pp 589-599 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Different categories of solid waste are examined from the point of view of origins, characteristics and quantities. The composition of household garbage in a Mediterranean municipal zone has been determined in the course of one year, demonstrating the potential application of ionizing radiation to sterilization of certain raw materials (putrescible matter, plastics and paper stock) obtained after separation of the garbage into components. An economic feasibility study of a planned separation and processing plant (1000 to 1200 ton/day) is discussed. A pilot plant (200 to 300 ton/day) to demonstrate the technological and economic feasibility of the process is described as well as research at present being conducted in several institutes for the production of radiation sterilized feed. The potential of ionizing radiation in solid waste treatment, as a tool facilitating resource recovery from solid municipal and agricultural wastes, is evaluated on the basis of the data presented. (auth)

8970 RADIATION RECYCLING PROCESS OF WASTE POLY-(TETRAFLUORETHYLENE) SCRAP. Kagiya, V. T. (Kyoto Univ.); Hagiwara, M. pp 601-612 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Poly(tetrafluorethylene) (PTFE) is well known as an excellent resinic material having high mechanical stiffness, resistance to chemicals, electrical insulation resistance and high melting temperature. At present, 12,000 to 15,000 short tons of PTFE are being supplied annually to the world market, and 2000 to 3000 tons of waste PTFE annually is expected to be recycled by passing through the reformation processes such as mechanical pulverization and thermal decomposition. However, mechanical pulverization is very difficult because of PTFE's stiffness and slippery property, and because the thermal decomposition process produces large amounts of various kinds of toxic fluorine compounds. This report describes a newly developed radiation recycling process of waste PTFE scrap to produce a fine powdery wax with molecular weight of 1×10^4 to 1×10^5. The PTFE waste scrap is decontaminated beforehand, and irradiated with gamma rays up to 5 to 20 Mrad at room temperature. The irradiated scrap is then heated at about 250 to 300°C for 5 to 10 h, and easily pulverized to fine powder. The application of heat is intended to accelerate the reduction of mechanical strength of the irradiated scrap by accomplishing the decomposition of the polymer radicals accumulated during the irradiation, and to stabilize it for use at higher temperature. The radiation process has several characteristic features: the evolution of toxic fluorine-containing compounds can be greatly diminished compared with that of the thermal decomposition process, and the irradiated scrap is more easily pulverized than non-irradiated scrap. It is probable that the radiation degradated powdery wax produced by this process may be put to many uses because of its excellent lubrication characteristics, antistatic properties and compatibility with other plastics. It is now being used as a 10 to 20% lubricating additive for many kinds of gears and plummer blocks made of various engineering resins such as nylons, polyacetals and polyesters. This process is in its final stages and began to run on a commercial scale in July 1974 to provide about 0.5 ton powdery wax monthly by reforming the chip or filament that comes from operations on plastics such as perforation and cutting. (auth)

8971 RADIATION FIXATION OF VINYL CHLORIDE IN AN INSECTICIDE AEROSOL CONTAINER. Kagiya, V. T.; Takemoto, K. (Kyoto Univ.). pp 613-620 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Recently, a large quantity of vinyl chloride has been used as spraying additive for insecticide aerosols. Since January 1974 when the Food and Drug Administration of the United States of America announced that vinyl chloride causes liver cancer, it has been forbidden in Japan and the United States of America to market insecticide aerosol containers containing vinyl chloride. In Japan, following a government order, about 20 million insecticide aerosol containers have been collected and put into storage. A report is given on the radiation fixation of vinyl chloride as polyvinylchloride powder by gamma-ray-induced polymerization in the aerosol container. Insecticide aerosol containers containing vinyl chloride were irradiated by gamma rays from ^{60}Co at room temperature. Vinyl chloride polymerized to form powdered polymer in the container. Polymerization conversion increased with the irradiation dose, and after 10 Mrad irradiation, vinyl chloride was not found in the sprayed gas. This establishes that vinyl chloride can be fixed by gamma-ray irradiation in the aerosol container. To accelerate the reaction rate, the effect of various additives on the reaction was investigated. It was found that halogenated hydrocarbons, such as chloroform and carbon tetrachloride, accelerated the initiation of the polymerization, and that a vinyl monomer such as vinyl acetate accelerated the reaction rate due to the promotion of the initiation and the high reactivity of the polyvinylacetate radical to vinyl chloride. Consequently, the required irradiation dose for the fixation of vinyl chloride was decreased to less than 5 Mrad by the addition of various kinds of additives. Following the request of the Ministry of Public Welfare, various technical problems for large-scale treatment are being studied with the cooperation of the Federation of Insecticide Aerosols. (auth)

8972 TREATMENT OF EXHAUST GASES BY IRRADIATION. Kawamura, K. (Ebara Manufacturing Co. Ltd., Fujisawa, Janagawa, Japan); Aoki, S.; Kawakami, W.; Hashimoti, S.; Machi, S. pp 621-631 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Studies are reported on the behavior of noxious gases, such as oxides of nitrogen (NO_x) and sulfur dioxide (SO_2) contained in heavy oil combustion gas, under the irradiation of electron beams. In the first stages of the studies, experiments were carried out in a batch system using a box-type reactor (22.5 liter) and an electron linear accelerator. The results of the experiments revealed that SO_2 contained in the gas could be almost completely removed by irradiation with a total dose of 3 Mrads. At the same time the formation of fine solid particles suspended in the irradiated gas was observed. Secondly, on the basis of the results in the batch experiments a flow-type apparatus was constructed comprising a box-type reactor whose volume was about one half of the batch reactor and a Cockcroft–Walton-type accelerator of 15 kW. This apparatus has been successfully operated to treat the gas continuously. Significantly NO_x as well as SO_2 were found to be simultaneously removed by irradiation, and the product to be a mixture of fine solid particles and a trace of sulfuric acid (H_2SO_4) which can be collected by an electrostatic precipitator. In the case of heavy oil combustion gases (10 Nm^3/H) containing SO_2 of 600 to 900 ppM and NO_x of about 80 ppM, the removal efficiency of SO_2 was 80% with irradiation of 4 Mrad, and more than 99% for NO_x with irradiation of 2 Mrad. The chemical structures of the solid products collected have not been determined, but the elementary analysis has shown the products to be composed of nitrogen, sulfur, hydrogen, and oxygen. (auth)

8973 KINETIC STUDY ON THE IRRADIATION OF EXHAUST GASES. Washino, M. (Japan Atomic Energy Research Inst., Takasaki); Tokunaga, O.; Hashimoto, S.; Kawakami, W.; Machi, S.; Kawamura, K.; Aoki, S. pp 633-642 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Kinetic studies were carried out on the removal of oxides of nitrogen (NO_x) and sulfur dioxide from the combustion gas in gas-flowing apparatus and from pure model gases in glass ampoules by electron beam irradiation. Results of the flow experiments show that the amount of decreased NO_x is proportional to the residence time and is not affected by the concentrations of both NO_x and SO_2, whereas the rate of decrease of SO_2 conforms to first order kinetics and is proportional to 1.3 power of the dose rate within the experimental conditions studied. The thermal decomposition of the product that reproduces some part of SO_2 is also suggested. The experiments on the pure SO_2-moist air system were carried out in thin-walled glass ampoules which were irradiated by an electron beam through a thin metal window of a temperature-regulated air bath. SO_2 is decreased by the irradiation only when water vapor is present suggesting the back reaction that is suppressed by the water molecules, and is expressed by a first order kinetic equation. The reaction of SO_2 removal was suppressed by the radical scavengers although it was not affected by the electron scavengers. As the concentration of NO_2 increased, the SO_2 removal was suppressed at temperatures above 100°C, although nitrosylsulfuric acid was formed at lower temperatures. To explain these results, reaction mechanisms are proposed for the oxidation of SO_2 to sulfuric acid and/or polymeric sulfuric anhydride. (auth)

Radiochemistry and Nuclear Chemistry

8974 (FRNC-TH-526) SYNTHESIS OF ^{14}C-LABELLED STEROIDS OF BIOLOGICAL INTEREST: PREGNENOLONE-^{14}C-4 BY THE INTERMEDIARY OF THE TRIMETHYLSILYL DERIVATIVE AND DIAMINO-3α,20α-PREGNENE-5-^{14}C-4. Hoellinger, H. (Paris-6 Univ., 75 (France)). 1974. 156p. (In French). Dep. NTIS (US Sales Only) $7.75.

Thesis.

Procedures for the synthesis of progesterone-^{14}C-4, pregnenolone-^{14}C-4, and pseudo-irehdiamine-^{14}C-4 were developed. The procedure developed for the labelling of progesterone was not significantly different from other procedures, but the higher yield obtained was attributed to its purification by the use of column and thin-layer chromatography. A new method was developed for the transformation of progesterone-^{14}C-4 into pregnenolone-^{14}C-4 by the silylation of the progesterone followed by the reduction of the silyl derivatives to obtain irehdiamine A. The synthesis of pseudo-irehdiamine-^{14}C-4 was realized by a similar procedure. The chemical and radiochemical purities of these compounds were rigorously controlled. (JSR)

Hot-Atom Chemistry

Refer also to abstract 8903.

8975 (CRN-CNPA-74-13) CHEMICAL EFFECTS CONNECTED TO THE (n,γ) REACTION ON PLATINUM ACETYLACETONATE. Belgrave, E. (Centre National de la Recherche Scientifique, 67-Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1974. 65p. (In French). INIS.

Platinum acetylacetonate samples were irradiated in a reactor. The retention measured by radiochemical analysis on ion exchange columns had the following values: ^{199}Pt 4%; ^{197}Pt 7.9%; ^{191}Pt 8.6%; $^{(197m)}$Pt 15.8%; $^{(195m)}$Pt 11.5%, and $^{(193m)}$Pt 17.9%. Some experiments were carried out in benzene and in a fast neutron flux. (FR)

8976 (CRN-CNPA-75-9) SZILARD–CHALMERS EFFECTS IN HAFNIUM CHELATES. I. Radiochemical Analysis. Marques-Netto, A.; Abbe, J. C. (Centre National de la Recherche Scientifique, 67- Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1975. 15p. Dep. NTIS (US Sales Only) $3.50.

Solid hafnium complexes of EDTA and CDTA together with the Na and NH_4 salts were synthesized. The retentions following (n,γ) activation were measured for ^{180m}Hf and ^{181}Hf. The influences of the irradiation times and of thermal annealing were investigated. (auth)

8977 MÖSSBAUER EMISSION SPECTRUM OF ^{121}Sb AFTER THE β^- DECAY OF ^{121m}Sn IN SnS_2: NUCLEAR DECAY SYNTHESIS OF ANTIMONY (V) SULFIDE. Ambe, S.; Ambe, F. (The Institute of Physical and Chemical Research, Wako-shi, Saitama 351, Japan). J. Chem. Phys. 63: No. 9, 4077-4078 (1 Nov 1975).

The Mössbauer spectrum of ^{121}Sb has been measured after β^- decay of ^{121m}Sn in SnS_2. The results indicate that a covalent antimony (V) compound was formed. This system offers the possibility of synthesizing Sb(V) compounds which have not obtained by other methods. (AIP)

8978 SZILARD–CHALMERS EFFECTS IN HAFNIUM COMPLEXES. II. Contribution of the Perturbed Angular Correlation Technique. Abbe, J. C.; Marques-Netto, A. (CNRS, Strasbourg). J. Inorg. Nucl. Chem.; 37: No. 11, 2239-2242(Nov 1975).

Time differential measurements of the 133 to 482 keV γ–γ angular correlation of ^{181}Ta have been performed in solid EDTA and CDTA hafnium complexes either labelled or irradiated in a reactor. The information deduced on the fate of the hot atoms is compared with data obtained through radiochemical analyses. (auth)

8979 SZILARD–CHALMERS EFFECTS IN HAFNIUM CHELATES. I. Radiochemical Analysis. Marques-Netto, A.; Abbe, J. C. (CNRS, Strasbourg). J. Inorg. Nucl. Chem.; 37: No. 11, 2235-2238(Nov 1975).

Solid hafnium complexes of EDTA and CDTA together with the Na and NH_4 salts have been synthesized. The retentions following (n,γ) activation have been measured for ^{180m}Hf and ^{181}Hf. The influences of the irradiation times and of thermal annealing have been investigated. (auth)

Properties of Radioactive Materials

Refer also to abstracts 8829, 9628, and 9717.

8980 (DP-MS-75-57) INTRODUCTION TO TRITIUM TECHNOLOGY. Meyer, L. H. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 14p. (CONF-751115-5). Dep. NTIS $4.50.

From 23rd conference on remote systems technology; San Francisco, California, USA (16 Nov 1975).

Some ways of making tritium technology information (now classified) available to the current fusion program workers are discussed. (LK)

8981 (KFK–2091) CALCULATION OF VAPOR PRESSURES OF OXIDE FUELS UP TO 5000°K FOR EQUILIBRIUM AND NON-EQUILIBRIUM EVAPORATION. Breitung, W. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Jun 1975. 79p. (In German). Dep. NTIS (US Sales Only) $5.50.

The evaporation kinetics of multicomponent systems was studied with UO_2 as the example. The evaporation, which is generally incongruent, implies that two opposing types of steady-state evaporation must be distinguished: equilibrium evaporation and "forced congruent" evaporation. A homogeneous composition of the material is maintained despite incongruent evaporation from the surface. This is ensured by sufficiently large diffusion flows towards the evaporating surface within the substance. By contrast, forced congruent evaporation occurring in the case of intensive evaporation gives rise to concentration gradients in the material, which are due to the high evaporation rates. The evaporating surface changes its composition such that congruent evaporation of the material takes place. The two types of evaporation indicated entail different vapor pressures. In some prompt critical reactor incidents forced congruent evaporation must be anticipated. Calculations of the vapor pressures of $UO_{2\pm x}$ and $(U,Pu)O_{2\pm x}$ for both types of evaporation up to temperature of 5000°K are included. The calculating procedures are based on the method of Rand and Markin (1967) incorporating recent thermodynamic data. The agreement between measured and calculated total pressures is good for the ranges of temperature and stoichiometry for which experimental results are available. This supports the results calculated for higher temperature ranges. (auth)

8982 THERMODYNAMIC PROPERTIES OF ACTINIDE COMPLEXES. II. Thorium(IV)-Acetate System. Portanova, R. (Univ., Padua); Di Bernardo, P.; Traverso, O.; Mazzocchin, G. A.; Magon, I. J. Inorg. Nucl. Chem.; 37: No. 10, 2177-2179(Oct 1975).

The changes in free energy, enthalpy and entropy for the formation of thorium(IV)-acetate complexes were determined at 25°C and in 1.00 M aqueous perchlorate medium. All five complexes formed were found to be stabilized by a large gain of entropy. The marked increase in the values of ΔH_j and ΔS_j, relative to the third step of complexation, is explained in terms of a coordination change. (auth)

8983 LABELLING OF FIBRINOGEN WITH TECHNETIUM-99m BY ELECTROLYTIC PREPARATION OF FREE ZIRCONIUM. Hebestreit, H. P.; Pryss, C. (Heidelberg Univ., Mannheim (F. R. Germany). Roentgeninstitut und Strahlenklinik). Nucl.-Med.; 14: No. 2, 172-184(Jun 1975). (In German).

6 figs.; 57 refs.

An electrolytic method for labelling fibrinogen with zirconium as a reductant for ^{99m}Tc is presented. The optimal labelling conditions and the in-vitro screening are subject of the study. First clinical experience indicates that the substance is clottable in vivo and applicable for localization. (auth)

8984 DETRAPPING OF INTERSTITIAL HELIUM IN METAL TRITIDES: NMR STUDIES. Weaver, H. T.; Camp, W. J. (Sandia Labs., Albuquerque, NM). Phys. Rev., B; 12: No. 8, 3054-3059 (15 Oct 1975).

Measurements of NMR line shapes and relaxation times were made for ^{3}H nuclei and their beta-decay products ^{3}He in aged samples of titanium tritide (Ti ^{3}H/sub x/). Data were obtained on samples aged 1 y (x equals 1,7) and 8 y (x equals 1,4), where x is the initial concentration. These data indicate that ^{3}He atoms are trapped interstitially in young crystals; whereas, in contrast, the older samples are found to contain helium-gas bubbles. Additionally, the younger sample was found to exhibit considerably more lattice distortion than the older sample. This is the first direct evidence for a detrapping mechanism which has been supported by a growing body of indirect evidence. A theory is described which explains the detrapping by a percolative mechanism: When enough ^{3}He atoms have been created to exceed a relevant critical percolation density, the helium atoms, which are considerably "oversized" for available interstices, are able to cooperatively strain the lattice beyond its elastic limit, hence irreversibly-deforming the lattice. The subsequent rapid diffusion of helium would then allow heterogeneous bubble nucleation with release of helium from the crystal by blistering and/or release along grain boundaries. (auth)

8985 LATTICE PARAMETERS OF THE ACTINIDE TETRAFLUORIDES UF_4, Bk_4, AND CfF_4. Haug, H. O. (Kernforschungszentrum, Karlsruhe, Ger.); Baybarz, R. D. Inorg. Nucl. Chem. Lett.; 11: No. 12, 847-855(Dec 1975).

This paper reports the determination of precise lattice parameters for UF_4 powder obtained by Guinier, diffractometer, and Debye-Scherrer x-ray diffraction methods. The line positions from a high resolution Guinier photograph were compared with diffraction data obtained from an x-ray diffractometer scan and Debye-Scherrer films (Straumanis mounting technique). The powder patterns were indexed by intercomparing these data and using theoretical intensities. BkF_4 and CfF_4 were also prepared, and lattice parameters were calculated that differ from those previously reported [Asprey et al., Inorg. Nucl. Chem. Letters 4:537(1968), and Keenan et al., Inorg. Chem. 8:235(1969)]. (auth)

8986 X-RAY DIFFRACTION AND SPECTROSCOPIC STUDIES OF CRYSTALLINE EINSTEINIUM(III) BROMIDE, $^{253}EsBr_3$. Fellows, R. L. (Univ. of Tennessee, Knoxville); Peterson, J. R.; Noe, M.; Young, J. P.; Haire, R. G. Inorg. Nucl. Chem. Lett.; 11: No. 11, 737-742(Nov 1975).

A report is presented on the preparation and characterization, by absorption spectroscopy and X-ray powder diffraction, of crystalline einsteinium (III) bromide, $^{253}EsBr_3$. An attempt to synthesize and characterize $EsBr_2$ is also reported. (UK)

8987 MIXED LIGAND DERIVATIVES OF 1:1 Th(IV)-DTPA CHELATE WITH SOME HYDROXY ACIDS(I). Pachauri, O. P.; Tandon, J. P. (Rajasthan Univ., Jaipur, India). J. Inorg. Nucl. Chem.; 37: No. 11, 2321-2323(Nov 1975).

The formation of a 1:1 Th(IV)-diethylenetriaminepentacetic acid (DTPA) hydroxo chelate has been reported pH metrically by Martell et al. [J. Am. Chem. Soc. 80:4170(1958)]. All the 8-coordination sites of the metal ion are satisfied by the octadentate DTPA. The 10-fold coordination of the metal ion can be shown if a bidentate ligand is added to the normal 1:1 Th(IV)-DTPA chelate. In view of this, potentiometric studies of the Th(IV)-DTPA systems in presence of some hydroxy acids (Tiron, chromotropic salt, pyrocatechol) have been carried out. The results are discussed. (auth)

8988 SCHIFF BASE COMPLEXES OF DIOXOURANIUM(VI). I. Dioxouranium(VI) Complexes of Monobasic Bidentate Schiff Bases. Vijay, R. G.; Tandon, J. P. (Rajasthan Univ., Jaipur, India). J. Inorg. Nucl. Chem.; 37: No. 11, 2326-2329(Nov 1975).

A survey of the literature reveals that Schiff base complexes of the type, $UO_2(NO_3)_2(SBH)_2$ (where SBH is the Schiff base derived from salicylaldehyde and alkyl amine) have been reported. However, in other complexes, the anions of the Schiff base are coordinated. In view of these two different types it was considered of interest to synthesize some new dioxouranium(VI) complexes with the monobasic bidentate Schiff bases such as 2,4-pentandione ethylimine, 2,4-pentandione-n-propylimine, 2,4-pentandione-n-butylimine, 2,4-pentandioneanil, o-hydroxyacetophenone-n-propylimine, o-hydroxyacetophenone-n-butylimine and o-hydroxyacetophenoneanil. Measurements of magnetic susceptibility, I. R. spectra, and conductance are reported. The results are discussed. (auth)

Radioactive Waste Treatment

Refer also to abstracts 9776 and 11356.

8989 (ICP-1084) DTA-X-RAY EVALUATION OF CHEMICAL REPROCESSING WASTES. Newby, B. J. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs - Operations Office). Oct 1975. Contract E(10-1)-1375. 45p. Dep. NTIS $5.45.

Differential thermal analysis (DTA) and x-ray diffraction were used to generate DTA curves for defining the calcination chemistry significantly affecting particle agglomeration during solidification. For wastes containing sodium nitrate, DTA curves were interpreted to determine the effectiveness of additives in causing sodium nitrate (or sodium nitrate-nitrite) decomposition or conversion to stable compounds within the temperature range of fluidized-bed calcination. (auth)

8990 (ORNL-TM-5077) USE OF CHEMICAL EQUILIBRIUM DATA TO CALCULATE IODOX COLUMN OPERATIONS. Mailen, J. C. (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 19p. Dep. NTIS $5.00.

In an operation whose chemical mechanism is complicated, such as Iodox, prediction of the operation with changes in operating parameters can be difficult. Correlations of the decontamination factors of Iodox for iodine and CH_3I as functions of chemical equilibria are presented. Different equilibria appear to be involved where nitrogen oxides are absent in the gas stream and where considerable quantities of nitrogen oxides are present. Two separate correlations will be developed to cover these two cases. (auth)

8991 (SRO-525-8) SEPARATIONS OF CATIONS USING PERMSELECTIVE MEMBRANE SYSTEMS AND COMPLEXING AGENTS. Rush, W. E.; Kizer, J. D.; Baker, B. L. (Hoechst Fibers, Inc., Spartanburg, S. C. (USA); Dow Badische Co., Anderson, S. C. (USA); South Carolina Univ., Columbia (USA)). 31p. (CONF-751107-8). Dep. NTIS $4.75.

From 68th annual meeting of American Institute of Chemical Engineering; Los Angeles, California, USA (16 Nov 1975).

The effects of complexing and chelating agents on Donnan dialysis when using ion exchange membranes to separate and/or concentrate ions were studied. It was found that ions of like charge can be separated by the use of ion exchange membranes using chelating agents under the proper conditions of pH and flow rates. Experimental runs on the following ions are reported: Na, H, Mg, Ca, Zn, and Fe. Calculations showing the required conditions were made with results that are good estimates depending on how well the pH of the solutions was known. Separation of ions of the same charge can be described qualitatively by relating the separation of the ions to flow rates of the raffinate and extract streams. The methods described may be applicable to the removal and/or concentration of ions from waste streams or from dilute solutions in process applications. (auth)

8992 PROCESS FOR THE PURIFICATION OF WASTE PRODUCT CALCIUM SULPHATE. Boontje, J. T. (to Unie Van Kunstmestfabrieken). British Patent 1,394,734/B/. 21 May 1975. Filed date 26 Apr 1972. 3p.

A process is described for the purification of waste product $CaSO_4$, which may be a by-product in the manufacture of phosphoric acid or fertilizers from natural phosphates. Waste product $CaSO_4$ may be used as a building material. The properties of the $CaSO_4$, with regard to this application, may be improved by removal of certain contaminants originating from the phosphate ore, such as a carbonaceous material that detracts from the whiteness of the product, and also radioactive contaminants. These contaminants are more concentrated in the finer particles than in the coarser particles, and a product of higher purity is obtained by classifying the product by particle size and removal of the fines. The various fractions are monitored for radioactivity. Classification is preferably effected using one or more hydrocyclones or by means of a curved screening deck. A suitable hydrocyclone is described, using an aqueous suspension of the sulfate as feed. (UK)

8993 ATOMIC WASTE MOLTEN INTO GLASS. Saidl, J. (Kernforschungszentrum Karlsruhe (F. R. Germany). Abt. Behandlung Radioaktiver Abfaelle). Nachr. Chem. Tech.; 23: No. 8, 151-152(Apr 1975). (In German).

3 tabs.

The solidification and the technology of the solidification of highly radioactive waste solutions are reported. A table of the chemical composition of the highly radioactive waste solution (KEWA standard, 3,600 Ci/ltr.) is presented. (GE)

8994 TECHNICAL EXCHANGE AND COOPERATIVE ARRANGEMENT BETWEEN THE UNITED STATES ATOMIC ENERGY COMMISSION AND THE FEDERAL MINISTRY FOR RESEARCH AND TECHNOLOGY OF THE FEDERAL REPUBLIC OF GERMANY IN THE FIELD OF MANAGEMENT OF RADIOACTIVE WASTES. Fundesgesetzblatt, Teil 2; No. 15, 268-275(1975). (In German, English).

The agreement became effective on December 20, 1974, according to its article 15; the complete text is reproduced in German and in English. (GE)

8995 PROBLEM OF WASTE FROM NUCLEAR POWER STATIONS WILL BE SOLVED. Backeus, L. Tek. Tidskr.; 104: No. 18, 29-30; 32(15 Nov 1974). (In Swedish)

A parliamentary report on the problem of the disposal of highly radioactive waste from nuclear power stations in Sweden is summarized. The following processes are described: storage in stainless steel tanks, calcined waste, bituminization (casting in asphalt) and vitrification. The prospects of finding geological formations in Sweden suitable for the storage of nuclear waste are discussed. (SW)

Radioisotope Production

Refer also to abstract 8903.

8996 CYCLOTRON-PRODUCED THULIUM-167 FOR BONE AND TUMOR SCANNING. Yano, Y.; Chu, P. (Univ. of California, Berkeley). Int. J. Nucl. Med. Biol.; 2: No. 3, 135-139(Jul 1975).

A method has been described for the cyclotron production of 9.6-day thulium-167. Ion exchange resin chromatography was used to separate the ^{167}Tm from the $HoCl_3$ target material. Distribution of the separated ^{167}Tm citrate in normal dogs and rats and in tumor-bearing mice has been determined. The results of these studies indicated that ^{167}Tm is potentially useful for tumor and bone scanning. (auth)

Reactor Fuel Reprocessing

Refer also to abstracts 9242 and 11351.

8997 (GA-A-13278) DISSOLUTION OF HTGR FUEL. Hutton, A. E. (General Atomic Co., San Diego, Calif. (USA)). 30 Sep 1975. Contract E(04-3)-167. vp. Dep. NTIS $10.60.

Status of the dissolution step for reprocessing the HTGR fuels from the Fort St. Vrain reactor is reported. The feasibility and desirability of (1) utilizing a batch 304L stainless steel dissolver and (2) boiling Thorex acid [13 M HNO_3/0.05 M HF/0.1 M $Al(NO_3)_3$] to dissolve HTGR fuel was established. Effects of variations in fuel physical properties and dissolver operating parameters on fuel dissolution rates were studied. As a result, it is also established that the dissolution rate of HTGR fuel is a function of the entire history of the fuel as well as of the operating parameters of the dissolver; i.e., HTGR fuel preparation and reprocessing methods can affect fuel particle size, density, etc., which in turn affect fuel dissolution rate. Even with this added complication, this

study establishes a range of expected dissolution rates for a range of expected dissolver feeds. A quantitative measure of gas holdup and required air sparge rates is also presented. A theoretical dissolution model is developed and discussed. Several operating difficulties in the pilot plant dissolvers tested are disclosed; notably, (1) difficulties in obtaining representative solid samples (dissolver feed and insolubles) resulted in uncertainties in material balances, (2) difficulties in keeping purgerator dip tubes clear of solids resulted in uncertainties in specific gravity and level measurements. Both of these problems should be addressed in future development work. Other recommendations for future experimental testing related to HTGR fuel dissolution are presented and discussed. (auth)

8998 (GA-A-13552) DIFFERENTIAL LEACHING STUDIES: HTGR FUEL REPROCESSING DEVELOPMENT. Wilbourn, R. G. (General Atomic Co., San Diego, Calif. (USA)). 1 Aug 1975. Contract E(04-3)-167. 21p. Dep. NTIS $4.00.

Differential leaching is defined as the ability to preferentially dissolve uranium from fissile particles rather than the bred uranium contained in fertile particles during HTGR fuel reprocessing. Thus, differential leaching offers a potential separation of parasitic ^{236}U from bred ^{233}U on a basis other than the difference between fissile and fertile particle size or density. Specifically, the solubility differences of U_3O_8, ThO_2, and mixed oxides in nitric acid form the basis for differential leaching. The application of differential leaching in various reprocessing flow sheets is considered. Data from previous and current investigations at General Atomic Company are presented. Some degree of separation of fertile particle ^{233}U from fissile particle ^{235}U and ^{236}U (separation factors 20 to 100) was obtained by treating simulated ash with nitric acid concentrations as low as 1 M. The success of any differential leaching flow sheet is strongly dependent on the irradiation exposure, Th/U ratio, fabrication technique, etc., of the material being leached. (auth)

8999 (GA-A-13593) THORIUM UTILIZATION PROGRAM. Quarterly Progress Report for the Period Ending August 31, 1975. (General Atomic Co., San Diego, Calif. (USA)). 30 Sep 1975. Contract E(04-3)-167. vp. Dep. NTIS $7.60.

This publication continues the quarterly series presenting results of work performed under the National HTGR Fuel Recycle Program (also known as the Thorium Utilization Program) at General Atomic Company. Results of work on this program prior to June 1974 were included in a quarterly series on the HTGR Base Program. The work reported includes the development of unit processes and equipment for reprocessing of High-Temperature Gas-Cooled Reactor (HTGR) fuel and the design and development of an integrated line to demonstrate the head end of HTGR reprocessing using unirradiated fuel materials. Work is also described on the evaluation of alternate techniques for fuel reprocessing to surmount possible operating problems with the reference flow sheet and the development of the conceptual design of a target recycle facility to identify the requirements of large-scale recycle of HTGR fuels. (auth)

9000 (HW-22076) LABORATORY DEMONSTRATION OF REDOX FEED HEAD-END TREATMENT: RUTHENIUM VOLATILIZATION AND MANGANESE DIOXIDE SCAVENGING. Hicks, H. G.; McCormack, C. G.; Roake, W. E. (Hanford Works, Richland, Wash. (USA)). 15 Jul 1951. 60p. Dep. NTIS $5.50.

Declassified 14 Jul 1975.

The mechanics of manganese dioxide handling, laboratory development of manganese dioxide scavenging, and a series of experiments at multicurie level combining ruthenium volatilization and manganese dioxide scavenging in stainless steel equipment are dealt with.

9001 (ORNL-5090) HEAD-END REPROCESSING STUDIES WITH IRRADIATED HTGR-TYPE FUELS. III. Studies with RTE-7: TRISO UC_2-TRISO ThC_2. Fitzgerald, C. L.; Vaughen, V. C. A.; Notz, K. J.; Lowrie, R. S. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 54p. Dep. NTIS $5.45.

Head-end reprocessing studies on irradiated Fort St. Vrain type HTGR fuel (TRISO coated UC_2-TRISO coated ThC_2) were performed. Fuel sticks were burned quiescently in oxygen at 750°C, the ash was screened to separate the fissile SiC-coated particles from the fertile SiC-coated particles, each particle fraction was crushed and burned separately in oxygen, and the secondary burner ash products were leached. These studies concentrated on the release of radionuclides to the burner off-gases after passing through a 20-mu m sintered metal frit held at 500°C. Fission product and heavy metal inventories were made on the process gaseous, liquid, and solid streams. Experimental results are compared with pre-irradiation average fuel stick compositions and with calculated fission product inventories. (auth)

9002 DESIGNING A LARGE REPROCESSING PLANT. Issel, W.; Knoch, W. (Kernbrennstoff-Wiederaufarbeitungsgesellschaft m.b.H., Leopoldshafen (F. R. Germany)). Atomwirtsch., Atomtech.; 20: No. 7, 339-342(Jul 1975). (In German)

3 figs.; 2 tabs.

Kernbrennstoff-Wiederaufarbeitungs-Gesellschaft m.b.H. (KEWA) is presently engaged in drafting a conceptual design study of a reprocessing plant to be built in the Federal Republic of Germany. The study is based on a number of assumptions and data which are outlined in more detail in this contribution, but which cannot anticipate the results of the conceptual design study still under way. The design is made for oxide fuels of boiling water and pressurized water reactors. Also plutonium recycle fuel will be considered with a contribution to the amount of fuel to be reprocessed rising up to 10%. The target burnup assumed is 40,000 MWd/t, the minimum cooling time 365 days at the beginning of reprocessing. For this first large German reprocessing plant a design capacity of 1,400 t U/a will meet the criteria needed for setting the capacity. The fuel solution is separated into uranium, plutonium and fission products in three extraction cycles based on the Purex flowsheet. All safety rules and regulations presently in force are taken into account in plant design and operation. The estimated investment cost is estimated to amount to DM 2 billion for a range between 1,000 and 2,000 t/a; this sum does not include the costs of waste solidification and storage. (auth)

9003 EUROPEAN REPROCESSING SCENE. Schlitt, A. (Kernbrennstoff-Wiederaufarbeitungsgesellschaft m.b.H., Leopoldshafen (F. R. Germany)). Atomwirtsch., Atomtech.; 20: No. 7, 335-338(Jul 1975). (In German)

1 fig.

The situation in the field of reprocessing spent oxide fuels has drastically deteriorated within a period of barely one year. After delays and setbacks in the United States, also European plans have accumulated major time delays, especially with respect to the British plant at Windscale and the French one at La Hague. As a result, there is a shortage instead of the overcapacity originally anticipated, which will continue to exist until the mid-eighties and will have to be accommodated initially by the immediate expansion of storage capacities for spent fuel elements. The British and French partners in URG indicate that they can contribute to reprocessing for German nuclear power plants after 1980 only if the planned KEWA plant is commissioned in time and according to schedule. However, even with the greatest effort and on the assumption of a smooth licensing procedure, the German plant will not be able to start full power operation before 1985. (auth)

9004 TREATMENT OF RADIOACTIVE WASTES FROM REPROCESSING PLANTS. Gasteiger, R. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik); Hoehlein, G. (Kernforschungszentrum Karlsruhe (F. R. Germany). Abt. Dekontaminationsbetriebe). Atomwirtsch., Atomtech.; 20: No. 7, 349-353(Jul 1975). (In German).

3 figs.; 4 tabs.; 17 refs.

The treatment and safe disposal of the radioactive wastes produced in reprocessing spent fuel elements has now reached a stage at which the quantities of wastes of various categories now generated can be safely handled and stored. The safe and economical treatment of radioactive wastes from future, much larger reprocessing plants is not yet ensured in every respect. Pending the clarification of the safety problems as yet unsolved in the concepts of secular storage, sufficiently large temporary storage facilities will have to be made available at any rate for a limited period of time. There are problems also in the concentration and solidification of liquid radioactive wastes, such as the tritium concentration of liquid low-level wastes and off-gas cleaning in connection with combustible solid low-level wastes. The article contains production and handling sketches for the different kinds of radioactive waste produced in reprocessing plants and gives data on the amount of wastes to be expected up to the year 2,010 from the reprocessing of LWR fuel elements in the FRG. It also gives a survey on the classification and treatment of wastes. (auth)

9005 OPERATING EXPERIENCE WITH WAK. Schueller, W.; Huppert, K. L.; Hoffmann, W. (Gesellschaft zur Wiederaufarbeitung von Kernbrennstoffen m.b.H., Leopoldshafen (F. R. Germany)). Atomwirtsch., Atomtech.; 20: No. 7, 342-346(Jul 1975). (In German)

4 figs.; 2 tabs.; 6 refs.

The Karlsruhe Reprocessing Plant WAK was built as a pilot plant between 1967 and 1970 and began active operation in the fall of 1971 following a commissioning program which involved several stages. The plant primarily serves the purpose of conveying operating experience and is used for the advancement of

the technology of chemical reprocessing of spent fuel elements. Operating experience so far has established important preconditions to the construction of a large reprocessing plant. While at the time WAK was planned, ten years ago, different reprocessing techniques were still under discussion, the PUREX flowsheet adopted in WAK is now internationally regarded as the only technique applicable on a large technical scale. Numerous improvements of the equipment brought about in the course of operation helped to improve the results of main and auxiliary process units. (auth)

CONTROLLED THERMONUCLEAR RESEARCH

Plasma Confinement and Heating

Refer also to abstracts 9087 and 9088.

9006 (EUR-CEA-FC-765) DIFFUSION OF PARTICLES OF PLASMA CONFINED DUE TO COLLISIONLESS DRIFT WAVES. Abdel-Shahid, N. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay- aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Mar 1975. 142p. INIS.

The cross-field transport of particles associated with collisionless drift waves, arising in a magnetically confined plasma was measured. The values obtained are compared with the numerical results derived from the linear dispersion relation. The experiments were carried out on the ODE device. The radial flux of particles was directly measured by auto and cross correlations between density and potential fluctuations using a real time correlator (band width 10 MHz) and its associated Fourier transformer (band width 250 MHz). In the determination of the radial flux Langmuir probes were used to measure the amplitudes and phase angles of the density, potential and temperature fluctuations associated with these drift waves. In the presence of temperature fluctuations the potential fluctuations are related to the probe floating potential fluctuations through a relation involving T(el) (the electron temperature fluctuations). Their determination is necessary to evaluate the particle transport and it has been made possible by a new simple method using the Langmuir probes themselves. (FR)

9007 (EUR-CEA-FC-767(Pt.1)) HOT ELECTRON TARGET PLASMAS. I. Circe Experiment. Bardet, R.; Briand, P.; Dupas, L.; Gormezano, C.; Melin, G.; Werkoff, F. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Grenoble, 38 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Service d'Ionique Generale). Apr 1975. 56p. (In French). INIS.

The main parameters of the CIRCE experiment are described. The plasma is obtained by the trapping of a plasma injected in a magnetic bottle by electron heating at cyclotron resonance. The plasma density lies between $5 \times 10^{11} cm^{-3}$ and $10^{12} cm^{-3}$, the electron temperature is about 100 keV and the ion temperature in the range of few hundred eV. Gross instabilities are not observed. The ratio of the plasma density to the neutral gas density inside the plasma, is higher than 100. Few kilowatts of R.F. power at 8GHz are sufficient to get these results which look to be encouraging for the creation of a more performing fast neutral plasma target using the CIRCE experiment concept. (FR)

9008 (EUR-CEA-FC-769) GENESIS OF TOROIDAL DISCHARGES. Papoular, R. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Apr 1975. 33p. INIS.

The breakdown and ionization of the filling gas of toroidal devices is analyzed. A model is set up to try and reproduce the main features of experimental results, which include upper and lower pressure and electric field thresholds, discharge formation time, particle loss and injection, and initial rates of increase in current and temperature. The model is compared with experiments on devices built at Fontenay-aux-Roses (TA2000 and TFR). Discrepancies between the model and experiment may be due to the existence of early run-aways. The absence of an efficient, uniform pre-ionization on TFR could be responsible for the appearance of these run-aways. It is concluded that impurities from the walls and limiter flow into the TFR plasma right from the start; the rate of influx is estimated for the first few milliseconds. This influx itself is considered as indicative of early run-aways. (FR)

9009 (LA-6044-PR, pp 42-53) STAGED THETA PINCH PROGRAM. Thomas, K.; Borkenhagen, W.; Call, D. Aug 1975.

In LASL Controlled Thermonuclear Research Program, Progress report, January–December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)).

The resonant heating concept is discussed. The layout of the staged theta pinch experiment is described, i.e., construction and engineering. (MOW)

9010 (LA-6044-PR, pp 81-87) IMPLOSION HEATING EXPERIMENT. Hammel, J. E.; Henins, I.; Jarboe, T. R.; Marshall, J.; Sherwood, A. R. Aug 1975.

In LASL Controlled Thermonuclear Research Program, Progress report, January–December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)).

The electrical circuit for the Implosion Heating Experiment (IHE) is described. Some failures in the system are discussed. Some diagnostic measurements using probes, image converter photography, and interferometry are mentioned. (MOW)

9011 (LA-6044-PR, pp 88-103) Z-PINCH PROGRAM. Baker, D. A.; Burkhardt, L. C.; DiMarco, J. N.; Forman, P. R.; Haberstich, A.; Howell, R. B.; Karr, H. J.; Phillips, J. A.; Schofield, A. E. Aug 1975.

In LASL Controlled Thermonuclear Research Program, Progress report, January–December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)).

The past year was spent studying the characteristics of the toroidal reversed field Z pinch experiment ZT-1 between 10^{10} A/s and 2×10^{11} A/s. The modes of machine operation and formation of reversed field profiles are discussed. The electron temperature during the preionization phase is described. Density and temperature measurements are outlined. (MOW)

9012 (LA-6044-PR, pp 116-121) EXPERIMENTAL PLASMA PHYSICS. Dreicer, H.; Banton, M. E.; Brownell, J. H.; Ellis, R. F.; Ingraham, J. C.; Wright, B. L. Aug 1975.

In LASL Controlled Thermonuclear Research Program, Progress report, January–December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)).

The program was devoted to the study of the plasma ac electrical resistivity and plasma heating produced by the application of hf electromagnetic radiation to fully ionized plasmas. Some data are given for the effect of intense ac electric fields on the electron–ion collision rate in a plasma. (MOW)

9013 (LRP–97/75) RESIDUAL PLASMA IN A STRAIGHT AZIMUTHAL PINCH. Hafner, P. (Ecole Polytechnique Federale, Lausanne (Switzerland)). Oct 1975. 97p. (In French). Dep. NTIS (US Sales Only) $6.00.

The evolution of the electron density in the outer regions of a fast theta pinch was measured by means of a laser interferometer. The measurements are compared with numerical calculations using a one-dimensional, three-fluid MHD code. The comparison shows that the tenuous plasma in the outer regions originates from an instability during the implosion phase of the pinch. (auth)

9014 CONDITIONS ESTABLISHED IN A LASER THERMONUCLEAR REACTOR CHAMBER BY A MICROEXPLOSION OF A TARGET. Afanas'ev, Yu.V.; Basov, N.G.; Volosevich, P.P.; Gamalii, E.G.; Isakov, A.I.; Krokhin, O.N.; Kurdyumov, S.P.; Rozanov, V.B.; Samarskii, A.A.; Sobolevskii, N.M. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 6, 647-649 (June 1975).

Calculations are made of the quantities (pressure, temperature, mass evaporated from the walls, energy evolved by neutrons in the lithium blanket, etc.) representing physical conditions in a reactor chamber. These conditions can be used as the starting point for the selection of the engineering design of a laser thermonuclear reactor. (auth)

9015 DIFFRACTION LOSSES IN A LASER-HEATED SOLENOID PLASMA. Steinhauer, L.C. (Mathematical Sciences Northwest, Inc., Bellevue, Washington 98009). J. Appl. Phys. 46: No. 11, 4747-4749 (Nov 1975).

A solution for diffraction loss of a laser beam propagating in a plasma light pipe is found by analogy to the tunnel effect of quantum mechanics. It is shown that diffraction tends to dissipate the beam layer by layer, working from the outside inward. A characteristic dissipation length can be defined for each layer of the beam. Diffraction is estimated for a very long narrow plasma relevant to the fusion reactor concept and is found not to be a significant loss mechanism. (auth)

9016 INVERSE BREMSSTRAHLUNG ENERGY ABSORPTION RATE. Shima, Y.; Yatom, H. (Soreq Nuclear Research Centre, Yavne, Israel). Phys. Rev. A 12: No. 5, 2106-2117 (Nov 1975).

The rate of energy absorption by inverse bremsstrahlung of a plasma in an oscillating electric field is calculated. An expression for this rate is obtained that is valid for all ranges of the electron-plasma temperature and density and the electric field flux intensity and polarization. Analytical formulas are obtained for high-flux intensities where the rate is independent of the electron-velocity-distribution function. (auth)

9017 REDUCTION OF CLASSICAL THERMAL CONDUCTIVITY UNDER THE INFLUENCE OF HIGH-POWER LASERS. Pearlman, J.S.; Anthes, J.P. (Sandia Laboratories,

Albuquerque, New Mexico 87115). Appl. Phys. Lett. 27: No. 11, 581-583 (1 Dec 1975).

Observation of the front and rear plasma expansions from a laser-irradiated thin film has been used to study the thermal conduction of polystyrene targets. The existence of reduced conductivity has been inferred above a threshold of 10^{14} W/cm^2. The percentage of laser radiation transmitted through the thin film decreased by an order of magnitude as the laser flux increased from 10^{13} to 10^{14} W/cm^2. (auth)

9018 ELECTRICAL TRIGGERING OF AN OPTICAL BREAKDOWN PLASMA WITH SUBNANOSECOND JITTER. Kwok, H.S.; Yablonovitch, E. (Gordon McKay Laboratory, Harvard University, Cambridge, Massachusetts 02138). Appl. Phys. Lett. 27: No. 11, 583-585 (1 Dec 1975).

We have shown that CO_2-laser-induced breakdown in ultraclean gas follows less than 1 nsec after the injection of free electrons into the focal volume. While this confirms our understanding of the plasma nucleation mechanisms, it is also the first example of a new class of electro-optic switch in which a small electrical signal is able to control the transmission of a powerful laser beam. (auth)

Plasma Diagnostics

9019 (COO-2229-10) SPACE AND TIME RESOLVED MEASUREMENTS IN MAGNETICALLY CONFINED PLASMAS USING A HEAVY ION BEAM PROBE. Jennings, W. C.; Hickok, R. L. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA)). 1975. 4p. (CONF-750871-1). Dep. NTIS $4.50.

From 22nd international conference of phenomena in ionized gases; Eindhoven, Netherlands (18 Aug 1975).

A heavy ion beam probe provides space and time resolved measurements of plasma density, space potential, electron temperature, and current density in energetic, magnetically confined plasmas. A new dual beam technique has been developed to separate density and electron temperature measurements by probing the plasma with two different ion species. An extension of this technique has been used in conjunction with a feedback controlled, electrostatic energy analyzer to yield the only direct, absolute measurement of plasma space potential. Calibration of the frequency response of the analyzer/detector system has permitted direct measurements of the amplitude and phase of both density and space potential oscillations associated with plasma instabilities. (auth)

9020 (ER-90) PLASMA-SCANNED MICHELSON INTERFEROMETRY. Bartlett, D. V.; Hewitt, R. G.; Robinson, L. C.; Tait, G. D. (Sydney Univ. (Australia). School of Physics). Sep 1975. 10p. Dep. NTIS (US Sales Only) $4.25.

The plasma-scanned far-infrared Michelson interferometer is described. The use of this device to measure electron densities in hydrogen discharge plasma is discussed. (MOW)

9021 (EUR-CEA-FC-764) MEASURING METHODS FOR THE TFR PLASMA DIAGNOSTICS. Etievant, C. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Feb 1975. 52p. (In French). INIS.

The measuring methods in operation or still under development for the diagnostics of the TFR plasma parameters (ion and electron temperatures, electron density, current density) are reviewed, the diagnostics of the electrical behavior of the discharge, the neutral gas densities, the impurities and the parameters of the plasma turbulence being also investigated. Actual works are principally devoted to: improving ion temperature measurements by the possible use of the Doppler effect or infrared incoherent scattering; improving n(e) and T(e) measurement by Thomson scattering; measuring the poloidal field and current density; measuring impurities by X and UV spectroscopy and measuring instabilities and turbulence. (FR)

9022 (EUR-CEA-FC-766) PROSPECTS FOR ION TEMPERATURE MEASUREMENTS IN JET BY THOMSON SCATTERING OF SUBMILLIMETRE WAVES. Whitbourn, L. B. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Mar 1975. 22p. INIS.

The Thomson scattering of submillimeter waves is envisaged as a possible means for measuring the ion temperature of the JET plasma. The present discussion is principally concerned with the practical limitations imposed to the method by the availability of high power pulsed sources and sensitive detectors and noise due to plasma emission at submillimeter wavelengths (bremsstrahlung and electron cyclotron emission). Coherent scattering from plasma wave (e.g. ion acoustic waves and electron drift waves) with millimeter and submillimeter waves are considered briefly. Further suitable development of lasers and heterodyne detectors would make such measurements possible. A pulsed HCN laser associated with a detector with a lower heterodyne noise equivalent power could then be used to advantage. For scattering with CH_3F laser the NEP of a Josephson junction would be adequate because a relatively high level of plasma emission is expected at 496 μm. (FR)

9023 (LA-6044-PR, pp 104-115) PLASMA DIAGNOSTICS. Jahoda, F. C.; Amsden, R. C.; Chandler, G. I. Aug 1975.

In LASL Controlled Thermonuclear Research Program. Progress report, January-December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)).

The HF laser side-on holographic interferometry system for the pinch devices is described. An automated data processing and computer control system is discussed. Some plasma measurements using Thomson scattering are given. (MOW)

9024 (ORNL-TM-5071) PROPOSED SPATIAL ION TEMPERATURE MEASUREMENT WITH A FIR LASER. Hutchinson, D. P.; Vander Sluis, K. L. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 28p. Dep. NTIS $4.00.

A feasibility study for measuring the ion temperature in a thermonuclear type plasma by ion Thomson scattering is presented. The study indicates that the measurement is possible with predictable improvements in FIR laser power and FIR detector development. The possibility of measuring the effective charge anti Z of a plasma using the same techniques is discussed. (auth)

9025 MULTIPLE-PASS INTERFEROMETER FOR ELECTRON AND ATOM DENSITY MEASUREMENTS IN SHOCK TUBE PLASMAS. Weiss, C. O.; Kotzan, B. (Technische Univ. Hannover (F. R. Germany). Inst. fuer Plasmaphysik). Appl. Phys.; 7: No. 3, 203-207(Jul 1975).

4 figs.; 12 refs.

An eleven-pass, two-wavelength interferometer for density measurements within the ionization relaxation region of rare-gas shock waves has been developed. The minimum detectable electron density is 1×10^{14} cm^{-3}. A method to calculate the electron temperature profile across the relaxation region from the measured density profiles is described. (auth)

9026 TIME-RESOLVED SPECTROSCOPIC OBSERVATIONS OF A HIGH-TEMPERATURE, HIGH-DENSITY PLASMA IN A VACUUM SPARK. Turechek, J. J.; Kunze, H. J. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Z. Phys., A; 273: No. 2, 111-121(Jun 1975).

9 figs.; 3 tabs.; 30 refs.

The discharge parameters of a low-inductance, high-current vacuum spark were optimized to produce a small "point" plasma with temperatures of 35 keV and densities higher than 10^{20} cm^{-3}. Using two Bragg-crystal spectrometers the time resolved x-ray emission was studied. Lines from helium-like and hydrogen-like ions of the elements titanium, iron, copper, and molybdenum were observed and compared with theoretical predictions. Satellite lines to the Lyman-α transition up to molybdenum are identified as radiative transitions from autoionizing levels of the doubly excited helium-like ionization stages. (auth)

9027 DETERMINATION OF PLASMA DENSITY FROM SPECTRA OF HELIUMLIKE IONS. Vinogradov, A.V.; Skobelev, I.Yu.; Yukov, E.A. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 6, 630-633 (June 1975).

A numerical calculation is reported of the ratio of the intensities of resonance and intercombination lines of multiply charged heliumlike ions. The influence of cascade transitions on this ratio is investigated for various values of the plasma density. Detailed calculated results are given for the plasma density range $N_e \sim 10^{19}$–10^{23} cm^{-3} because this range is of interest in laser heating experiments. (auth)

9028 X-RAY SPECTROSCOPIC INVESTIGATION OF THE SPATIAL STRUCTURE OF A LASER PLASMA WITH ELECTRON DENSITIES IN THE RANGE 10^{18}–10^{21} cm^{-3}. Boiko, V.A.; Pikuz, S.A.; Faenov, A.Ya. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 6, 658-663 (June 1975).

Measurements were made of the spatial distributions (with a resolution of 65 μ) of the intensities of spectral lines of heliumlike multiply charged ions emitting in the range λ=4–10 Å. These measurements made it possible to determine for the first time the electron density profile in the 10^{18}–10^{21} cm^{-3} range near the point of reflection of a plasma-heating laser beam from a target as well as the profile of the electron temperature T_e at distances up to $r \sim 0.8$ mm from the target surface. The maximum electron temperature measured in

this way was 0.8 keV. The characteristic size of plasma inhomogeneities was estimated to be $\sim 9\times10^{-3}$ cm. A comparison was made of the capabilities of interferometric and spectroscopic methods in measurements of plasma parameters. (auth)

9029 PARAMETRIC RESONANCE AND DIAGNOSTICS OF A LASER PLASMA. Krokhin, O.N.; Pustovalov, V.V.; Rupasov, A.A.; Silin, V.P.; Sklizkov, G.V.; Starodub, A.N.; Tikhonchuk, V.P.; Shikanov, A.S. (P. N. Lebedev Physics Institute, USSR Academy of Sciences). JETP Lett. 22: No. 1, 21-23 (5 July 1975).

Results are presented of measurements of the spectral composition of the radiation reflected (scattered) by a plasma produced when a high-power neodymium-laser beam is focused on a flat target. It is shown on the basis of a comparative analysis of the results of the experiment and of the theory of parametric resonance in a plasma that the electron temperature in the region of the critical density can be determined from the experimentally observed red shift of the intensity of the second harmonic of the laser radiation. (auth)

9030 SURFACE CONTAMINATION OF ACTIVE ELECTRODES IN PLASMAS: DISTORTION OF CONVENTIONAL LANGMUIR PROBE MEASUREMENTS. Szuszczewicz, E.P.; Holmes, J.C. (E. O. Hulburt Center for Space Research, Naval Research Laboratory, Washington, D. C. 20375). J. Appl. Phys. 46: No. 12, 5134-5139 (Dec 1975).

Laboratory experiments were conducted to determine the effectiveness of a newly developed pulse technique in eliminating surface contamination effects and associated hysteresis in Langmuir probe current-voltage characteristics. We found that (i) the pulse technique was superior to the conventional continuous sweep approach to Langmuir probe diagnostics; (ii) substantial potentials can develop across contaminating surface layers and that these potentials can vary in the conventional Langmuir procedure resulting in determinations of electron energies higher than actually present in the ambient plasma; and (iii) attempts to achieve "clean-probe" operation by heating can be of limited value. (auth)

9031 OLYMPUS PROGRAMMING SYSTEM. Roberts, K. V. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). Atom (London); No. 226, 137-147(Aug 1975).

From computing techniques in physics; Castle Smolenice, Czechoslavakia (5 Jun 1975).

The OLYMPUS programming system, designed and implemented at the UKAEA Culham Laboratory, is intended to be used internationally by controlled thermonuclear research projects for computer analysis of plasma physics and engineering problems. Standard Fortran has been used to write the programs. The portability, immutability and flexibility, architecture, notation, lay-out and documentation, control, diagnostics, construction and testing, and the automatic program generation of the system are discussed. (UK)

9032 X-RAY EMISSION FROM CO 2-LASER-PRODUCED PLASMAS AT POWERS UP TO APPROXIMATELY 10W/cm^2 FOR 26 ELEMENTS. McMordie, J. A.; Simmons, A. C. (Atomic Weapons Research Establishment, Aldermaston, Eng.). J. Phys., D (London); 8: No. 12, L133-L136(21 Aug 1975).

The x-ray emission from CO_2-laser-produced plasmas has been studied for target elements covering the atomic number range Z = 6 to 92. For irradiations of $\sim 7\times10^{10}$ W cm^{-2} the x-ray yield was less than $\sim 3\times10^{-6}$. Plasma temperature has been measured as a function of incident power over the range (2 to 8) $\times$ 10^{10} W cm^{-2} for carbon and titanium and is typically 100 to 150 eV. (auth)

Plasma Kinetics (General)

9033 ELEMENTARE PLASMAPHYSIK. (Elementary Plasma Physics). Kippenhahn, R.; Moellenhoff, C. (Goettingen Univ. (F. R. Germany). Sternwarte). Mannheim, F. R. Germany; Bibliographisches Institut (1975). 297p.

With figs.; 69 refs.

The various properties of matter in the plasma state are dealt with in a comprehensive manner. After a few introductory remarks on the movement of single charged particles, the magnetohydrokinematic and then the magnetohydrodynamic behaviour of plasmas are studied, and plasma waves are explained mathematically. These investigations of non-conductive plasmas are illustrated by studies of magnetic fields of rotating stars. The two-component theory which is discussed afterwards accounts for the case of conductive plasmas and explains several new phenomena. Finally, the description of the plasma is further improved with the aid of a statistical theory which now serves as a fundamental element in plasma physics research. (GE)

9034 ION-INDUCED PINCH AND THE ENHANCEMENT OF ION CURRENT BY PINCHED ELECTRON FLOW IN RELATIVISTIC DIODES. Goldstein, S.A. (University of Maryland, College Park, Maryland 20742); Lee, R. Phys. Rev. Lett. 35: No. 16, 1079-1082 (20 Oct 1975).

A new model for time-dependent and steady-state ion and electron flow in large-aspect-ratio diodes is constructed. The electron trajectories are computed with use of the self-consistent fields calculated during the initial ion motion. The dynamic formation of a tightly pinched electron flow is qualitatively explained. Very large ion currents, nearly equal to the electron current, are predicted for flat solid cathodes, when steady-state flow is achieved. (auth)

9035 INFLUENCE OF ANODE COMPOSITION ON THE ELECTRICAL PROPERTIES OF RELATIVISTIC ELECTRON-BEAM DIODES. Kelly, J.G.; Goldstein, S.A.; Swain, D.W. (Sandia Laboratories, Albuquerque, New Mexico 87115). J. Appl. Phys. 46: No. 11, 4726-4729 (Nov 1975).

Current, voltage, x-ray, and witness plate measurements of the diode characteristics of the Nereus accelerator (150 kV, 50 kA) have shown that the composition of the anode can have a profound effect on the properties of the electron beam. In particular, if the anode is heated to remove absorbed gases and volatile impurities, the diode impedance holds up longer than in the case of an anode having an unprepared surface or one that has been covered with an easily vaporized low-Z substance (which leads to very rapid diode shorting). The fact that the anode surface can influence the electron current less than 10 ns into the beam pulse, before space-charge-limited electron flow has been established, indicates that ions, plasmas, or photons are generated at the anode and cross the diode gap before the electron beam has deposited more than 1 cal/cm^2 into the anode. (auth)

9036 H$^-$ SHAPE-RESONANCE STUDIES IN AN ARC PLASMA. Ott, W.R. (Institute for Basic Standards, National Bureau of Standards, Washington, D.C. 20234); Slater, J.; Cooper, J.; Gieres, G. Phys. Rev. A 12: No. 5, 2009-2016 (Nov 1975).

Calculations by Macek have shown that the H$^-$ photoabsorption cross section should be affected by a shape resonance at 1129.5 A. This experiment is an attempt to observe the resonance in emission according to the reaction $e + H \rightarrow [H^-]^* \rightarrow H^- + h\nu$. The plasma is in a condition of local thermodynamic equilibrium and is generated by a stationary wall-stabilized hydrogen arc. With an axis temperature of 14 000 K and 1 atm pressure, the H$^-$ free-bound continuum contributes only about 2% of the total radiation which is dominated in the 1130-Å region by the Ly-α wing. However, the peak of the shape resonance, according to Macek, should have a cross section about 25 times greater than the continuous free-bound cross section; therefore, it should appear as a very noticeable 50% structure superimposed on the Ly-α wing. Except for some small features which are attributed to weak molecular emission, there is no obvious indication of the shape resonance in either deuterium or hydrogen spectra between 1105 and 1135 Å. It is estimated that the minimum feature which could have been detected at 1129 Å was about 2% of the total signal. (auth)

Plasma Kinetics (Experimental)

9037 VACUUM ARC ANODE PLASMA. I. SPECTROSCOPIC INVESTIGATION. Bacon, F.M. (Sandia Laboratories, Albuquerque, New Mexico 87115). J. Appl. Phys. 46: No. 11, 4750-4757 (Nov 1975).

A spectroscopic investigation was made of the anode plasma of a pulsed vacuum arc with an aluminum anode and a molybdenum cathode. The arc was triggered by a third trigger electrode and was driven by a 150-A 10-μs current pulse. The average current density at the anode was sufficiently high that anode spots were formed; these spots are believed to be the source of the aluminum in the plasma investigated in this experiment. By simultaneously measuring spectral emission lines of Al I, Al II, and Al III, the plasma electron temperature was shown to decrease sequentially through the norm temperatures of Al III, Al II, and Al I as the arc was extinguished. The Boltzmann distribution temperature T_D of four Al III excited levels was shown to be $kT_D/e = 2.0\pm0.5$ V, and the peak Al III 4D excited state density was shown to be about 5×10^{17} m^{-3}. These data suggest a non-local-thermodynamic-equilibrium (non-LTE) model of the anode plasma when compared with the Al^{3+} production in the plasma. The plasma was theoretically shown to be optically thin to the observed Al III spectral lines. (auth)

Plasma Kinetics (Theoretical)

9038 (CEA-N-1803) FOCUS NEUTRON SPECTRA. II. Calculation of a Distribution Function of Accelerated Deuterons From the Experimental Spectra. Genta, P.; Millet, F.; Vezin, R. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). 28 Mar 1975. 96p. (In French). INIS.

Bernstein simplifying hypotheses are used to describe the FOCUS plasma producing nuclear reactions, by means of two

populations: the accelerated deuterons described by the space-time mean value of their single velocity distribution $f^1(E(d), \theta(d))$; and a beam of target deuterons with a kinetic energy E(T). The neutron spectrum $S(M)(P_0,E,\theta(n))$ being obtained by a time-of-flight measurement, a possible determination of the function $f^1(E(d), \theta(d))$ giving the same spectrum is developed. When $\theta(n)$ is not zero, the Gauss-Legendre two-step method used for the programming allows a precise computation for the infinite branches. There is no difficulty in the case where $\theta(n) = 0, \pi$. A discrete solution is developed from two or three different values of $\theta(n)$ and a ten energy values with 100 keV steps. The minimization leads to solving a linear system by the Gauss-Seidel method. (FR)

9039 (JUL-919-MA) APPROXIMATION OF THE VLASOV EQUATION BY A SYSTEM OF LINEAR INTEGRAL EQUATIONS. Profant, M. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralinstitut fuer Angewandte Mathematik). Feb 1973. 27p. (In German). Dep. NTIS (US Sales Only) $5.00.

The purpose of the present study is to state an algorithm with which the higher approximations of the Vlasov equation can be determined. The study is limited to a one-dimensional electron plasma with homogeneous ion background. The Volterra integral equations for the higher approximations of the electrical field are formulated. These are then clearly soluble in the faltung algebra of the generalized functions. The solutions lie in a very special vector subspace of the classical functions. This shows the algebraic character of the problem and makes it possible to state an algorithm so that the individual approximations can be determined explicitly. Numerical evaluations were made with a symbolic program language FORMAC. These showed that the third approximation, in contrast to the second approximation, can influence significantly the behavior of the field energy. (JSR)

9040 (UCRL-77047) INTERACTION OF RELATIVISTIC ELECTRON BEAMS WITH HIGH Z PLASMAS. Kershaw, D. S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 Oct 1975. 14p. (CONF-751130-11). Dep. NTIS $4.50.

From ASP meeting; St. Petersburg, Florida, USA (10 Nov 1975).

A set of relativistic multigroup diffusion equations was derived for the study of electron beam–target interactions. Included are transport, Coulomb collisions, electric and magnetic fields, bremsstrahlung, and hydrodynamic motion of the background plasma. LASNEX, the Laser-Fusion code, is being modified to include these equations and will be used for modeling electron beam fusion. (auth)

9041 STEADY STATE AND TRANSIENT SELF-INTERACTION OF A LASER BEAM IN A STRONGLY IONIZED MOVING PLASMA. Sodha, M. S.; Kaushik, S. C.; Kumar, A. (Indian Inst. of Tech., New Delhi. Dept. of Physics). Appl. Phys.; 7: No. 3, 187-193 (Jul 1975).

5 figs.; 15 refs.

The steady state and transient self-interaction of a laser beam with a strongly ionized plasma flowing transverse to the direction of propagation have been investigated by a phenomenological approach using perturbation theory, WKB and paraxial ray approximations. The effect of the transverse motion of the plasma has been included by a convection term in the energy balance equation and is found to result in the non-symmetrical heating of electrons. As a result the beam is shifted towards the direction of transverse flow of the plasma by an amount that increases with the flow velocity. The extent of asymmetry in self-focusing along the transverse directions is, however very small. In a typical case of a 7.6×10^5 watt laser of $\omega = 10^4$ GHz and an initial beam width $r_0 = 0.05$ cm the transverse shift $x_p = 0.1\ r_0$ is predicted in a distance of propagation $z = 0.34$ cm in a strongly ionized plasma of electron density $N_e = 10^{16}$ cm^{-3} and transverse flow velocity $W_0 = 10^7$ cm/sec. (auth)

9042 METHOD OF UTILIZATION OF THE RADIATION GENERATED BY NUCLEAR FUSION. Teitel, R. J. (to Texas Gas Transmission Corp.). German(FRG) Patent 2,449,230/A/. 22 May 1975. 13p. (In German).

1 fig.

The radiation produced in nuclear fusion reactions has a radiolytic, photolytic and/or thermolytic effect on CO_2-H_2O mixtures and produces H_2, CO and O_2 mixtures. Possible means of separating the hydrogen from the mixtures are described. (GE)

9043 SLOWING DOWN OF FAST IONS IN A SMALL-DIAMETER PLASMA SPHERE. Kryuchenkov, V.B. Sov. J. Quantum Electron. 5: No. 6, 663-665 (June 1975).

A calculation is given of the time dependence of the energy losses experienced by fast ions in a laser-beam-heated small-diameter plasma drop ($d \lesssim l$, where l is the mean free path of a fast ion in the investigated plasma). It is assumed that the plasma temperature lies in the range in which the electron-ion collisions are the dominant mechanism of the deceleration of fast ions. (auth)

9044 VACUUM ARC ANODE PLASMA. II. COLLISIONAL-RADIATIVE MODEL AND COMPARISON WITH EXPERIMENT. Bacon, F.M.; Watts, H.A. (Sandia Laboratories, Albuquerque, New Mexico 87115). J. Appl. Phys. 46: No. 11, 4758-4766 (Nov 1975).

A one-dimensional model describing the ionization and excitation of Al^{2+} ions in the anode plasma of a vacuum arc is developed using collisional-radiative ionization and recombination coefficients. The model is constructed so that local thermodynamic equilibrium (LTE) is approached in the collision-dominated limit; however, when the results of the model are compared with the experimental data, the anode plasma is shown not to be in LTE. The experimental and theoretical results are shown to be consistent for $N_e \simeq 5 \times 10^{20}$ m^{-3} and $kT_e/e \simeq 30$ V within about 0.3 mm of the anode surface. At distances greater than 0.3 mm from the anode, $kT_e/e < 15$ V. The change in T_e at $Z = 0.3$ mm suggests that a potential "hump" exists in the anode plasma out to $Z = 0.3$ mm. Theoretical Al^{2+} excited-state densities are shown to be related by a Boltzmann factor with a "temperature" that is considerably less than and independent of the electron temperature in the plasma. (auth)

Plasma Stability

9045 (LA-6044-PR, pp 31-41) FEEDBACK STABILIZATION OF SCYLLAC. Call, D. L.; Kutac, K. J.; Miller, G.; Quinn, W. E. Aug 1975.

In LASL Controlled Thermonuclear Research Program, Progress report, January–December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)).

The MHD feedback stabilization theory for the Scyllac device is reviewed. The theory covers scaling, feedback parameters, frequency response analysis, and equations of motion. (MOW)

9046 (LA-6044-PR, pp 122-144) THEORETICAL PHYSICS PROGRAM. Riesenfeld, W. B.; Baker, D. A.; Barnes, D. Aug 1975.

In LASL Controlled Thermonuclear Research Program, Progress report, January–December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)).

During the reporting year the LASL CTR theory group has continued to increase its efforts in the field of magnetohydrodynamics (MHD) theory as applied to the equilibrium and stability of complex toroidal confinement systems such as Scyllac and high-beta tokamaks. The second field which has seen concentrated efforts is the area of Vlasov analysis and numerical computation. Much work was done to map out and analyze high-beta electromagnetic microinstabilities acting in theta and Z-pinch implosion sheaths, and to refine several formulations of the so-called hybrid plasma model in which the ions are treated kinetically through the Vlasov equations while the electrons are considered to form a charge neutralizing MHD or drift fluid. In a third area of work, the numerical Computer Applications program has made significant contributions to the experimental programs by modeling the dynamics of Z-pinches and theta pinches using various physical models for the plasma. Finally, considerable effort has been expended on scaling studies of the feedback, wall stabilization, and staging requirements of Scyllac-like confinement systems. (MOW)

9047 (MATT-1182) ION-BEAM-DRIVEN RESONANT ION CYCLOTRON INSTABILITY. Hendel, H. W.; Yamada, M.; Seiler, S. W.; Ikezi, H. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Nov 1975. Contract E(11-1)-3073. 10p. Dep. NTIS $4.00.

The resonant ion-beam-driven electrostatic ion cyclotron instability is identified. Measured dispersion relation and onset vs. beam energy and density agree with numerical calculations based on a theory which includes beam acoustic terms. After amplitude saturation, velocity space diffusion of the beam ions is observed. (auth)

9048 PARAMETRIC INTERACTIONS OF FOUR ELECTROMAGNETIC WAVES DUE TO RELATIVISTIC AND OTHER NONLINEAR EFFECTS IN PLASMAS. Chakraborty, B. (Department of Mathematics, Jadavpur University, Calcutta-32, India). Phys. Rev. A 12: No. 5, 2153-2161 (Nov 1975).

Parametric interactions between four electromagnetic waves subjected to a linear phase-matching condition have been considered in a plasma. The relativistic equation of motion of a single electron has been used. The evolution of two signal waves in time by two powerful pump fields has been studied. The largest contributions to frequency shifts and growth rates are found to come from the relativistic correction source. Moreover, in some cases of frequencies very large compared to the

characteristic plasma frequency, a part of the relativistic effects totally cancels the other nonlinear effects. When the beat frequency of two of the waves equals the characteristic plasma frequency and in the neighborhood of this condition, the contributions from the nonrelativistic nonlinear sources are found to dominate. The frequency shifts and growth rates for high laser powers are considerable. (auth)

9049 LOWER HYBRID AND OTHER TEMPERATURE ANISOTROPY INSTABILITIES. Landau, R.W. (Tel-Aviv University, Ramat-Aviv, Israel and Culham Laboratory, Abingdon, Berkshire, England). Phys. Rev. A 12: No. 5, 2168-2176 (Nov 1975).

We have found a new instability for a Maxwellian plasma immersed in a uniform magnetic field with frequency near the lower-hybrid frequency. For zero perpendicular temperature and equal ion and electron temperatures, the mode is unstable for $\beta=4\pi nT/B^2 > 0.549$ with maximum growth for almost perpendicular propagation. This instability is in addition to the usual "hose" instability for parallel propagation and the two modes with zero real part (the ion mode of Forslund and our recent electron mode), both of which grow fastest for almost perpendicular propagation. (auth)

9050 THE EFFECT OF ION-CYCLOTRON MOTION ON THE TRANSVERSE INTERACTIONS IN BEAM-PLASMA SYSTEMS. Demokan, O. (Department of Physics, Middle East Technical University, Ankara, Turkey). J. Appl. Phys. 46: No. 12, 5150-5151 (Dec 1975).

In this work the instability of the transverse modes with left-hand polarization and frequencies around the ion-cyclotron frequency, propagating parallel to an external magnetic field in an unbounded homogeneous electron beam-plasma system, is investigated. The beam velocity is assumed to be parallel to the magnetic field. The ion distribution is assumed to have a certain velocity spread perpendicular to the external magnetic field, as a result of a possible ion-cyclotron resonance interaction with the instability. It is shown that even for very small values of this average perpendicular velocity the instability ceases to exist, practically regardless of the value of the beam velocity. (auth)

9051 NEW FINITE ELEMENT APPROACH TO THE NORMAL MODE ANALYSIS IN MAGNETOHYDRODYNAMICS. Appert, K.; Berger, D.; Gruber, R.; Rappaz, J. (Centre de Recherches en Physique des Plasmas, Lausanne, Switzerland). J. Comput. Phys.; 18: No. 3, 284-299 (Jul 1975).

The eigenvalue problem arising in the one-dimensional normal mode analysis of fixed boundary magnetohydrodynamic stability is solved by a finite element method. Piecewise constant, discontinuous basis functions are used for two components of the displacement vector because this permits an accurate representation of the nearly divergence-free property of the modes being treated. In spite of the simple basis functions, the accuracy is greatly improved compared to that obtained with piecewise linear, continuous basis functions. Important features of the spectrum, such as infinitely degenerated eigenvalues, accumulation points, and continua, are well represented by the method. The method used is equally well applicable to the free boundary stability problem. (auth)

Thermonuclear Engineering and Equipment

Refer also to abstracts 9188 and 9894.

9052 (ANL/HEP-CP-75-69) SUPERCONDUCTING EQUILIBRIUM COIL DESIGN STUDIES FOR THE ARGONNE EXPERIMENTAL POWER REACTOR. Wang, S. T.; Purcell, J. R.; Turner, L. R. (Argonne National Lab., Ill. (USA)). Nov 1975. Contract W-31-109-Eng-38. 7p. (CONF-751125-76). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

As an integral effort in the Argonne Experimental Power Reactor design studies, a scoping-study was made on the equilibrium coil system. Various design options were investigated. The reference design is a superconducting equilibrium field coil system located outside the toroidal field coils for reasons of ease of coil assembly, disassembly, coil support, remote maintenance and the least interference with the assembly and disassembly of the first wall and the blanket and shield. It was also found that there is a large I^2R loss if the coils were made of water-cooled copper. The superconducting equilibrium coil design was developed in considerable detail with the 60,000 A ac superconducting low loss cable design, ac pulsing loss evaluation and the full stabilization examination. The proposed superconductor is NbTi with copper and cupro-nickel as two-component matrix. Finally, the equilibrium field requirements are also discussed. (auth)

9053 (BNL-19947) ANALYSIS OF STEADY-STATE AND PULSED OPERATING REGIMES FOR CONTROLLED THERMONUCLEAR REACTORS WITH VERY LARGE POWER RATINGS. Usher, J. L.; Powell, J. R. (Brookhaven National Lab., Upton, N. Y. (USA)). Mar 1975. 121p. Dep. NTIS $6.50.

The operating regimes of large CTR's are identified and examined for cases of steady-state and pulsed operation. Several technological benefits of these large reactors are determined: (1) low maximum magnetic field strength requirements (25 to 50 percent less than for 5000 MW(th) reactors), (2) high n tau products (10^{15} to 10^{17} sec/cm^3) with associated high burn-up fractions (10 to 50 percent), (3) relatively little problem with impurity build-up, and (4) long confinement times (50 to 500 seconds). The advantages of pulsed operation are also discussed: (1) smaller problem with impurities than in the steady-state case, (2) alleviation of any possible fueling difficulties, and (3) no problem with control of temperature in the pulsed reactor based on a simple control function model incorporating a finite delay time. (auth)

9054 (BNL-20656) INTENSE NEGATIVE HYDROGEN ION SOURCE FOR NEUTRAL INJECTION INTO TOKAMAKS. Prelec, K.; Sluyters, T. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 5p. (CONF-751125-87). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

In this scheme negative ions are extracted from a plasma source, accelerated to the required energy and then neutralized by stripping in a gas, metal vapor or plasma jet. One of the most promising direct extraction sources is the magnetron source, operating in the mixed hydrogen-cesium mode. In the present source cathode current densities are up to 20 A/cm^2 at arc voltages between 100 V and 150 V. In order to utilize the discharge more efficiently multislit extraction geometry was adopted. Highest currents were obtained by using six slits, with a total extraction area of 1.35 cm^2. At an extraction voltage of 18 kV negative hydrogen ion currents close to 1 A were obtained, which corresponds to current densities of about 0.7 A/cm^2 at the extraction aperture. Pulse length was 10–20 ms and the repetition rate 0.1 Hz. The total extracted current was usually 2–3 times the H^- current. (auth)

9055 (BNL-20681) CRYOCONDENSATION PUMPING OF THICK FILMS OF HYDROGEN AND DEUTERIUM. Halams, H. J.; Bamberger, J. A. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 10p. (CONF-751125-81). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

In order to obtain engineering data for design of large capacity cryopumps for hydrogen, deuterium and tritium, an apparatus was built where pumping speeds and sticking coefficients can be studied as a function of surface coverage for different leak rates. In addition, thermal conductivity and thermal absorption of these frozen gases can be inferred from the measurements of pumping speed equilibrium pressure and the helium boil-off rate. The following changes in the above parameters were observed when the surface coverage was increased from a few atomic layers to 3.8×10^{20} molecules cm^{-2} for H_2 and 1.2×10^{21} molecules cm^{-2} for D_2: the pumping speed decreased about 10 percent while the equilibrium pressure and helium boil-off were unchanged within the limits of our measuring accuracy; changing the gas leak rate from 0 to 2×10^{-3} Torr liters sec^{-1} cm^{-2} also decreases the pumping speed by approximately 10 percent. From the above measurements it is inferred that thermal absorption to frozen H_2 and D_2 is negligible. Based on the information obtained in our investigation we designed a cryopump having a pumping speed of 10^5 liters sec^{-1} for hydrogen. (auth)

9056 (CONF-750989-1) EXPERIMENTAL STUDIES OF TRITIUM BARRIER CONCEPTS FOR FUSION REACTORS. Maroni, V. A.; Van Deventer, E. H.; Renner, T. A.; Pelto, R. H.; Wierdak, C. J. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 34p. Dep. NTIS $5.00.

From international conference on radiation effects and tritium technology for fusion reactors; Gatlinburg, Tennessee, USA (30 Sep 1975).

Ongoing experimental studies at ANL aimed at the development of methods to reduce tritium migration in fusion reactor systems currently include (1) work on the development of multilayered metal composites and impurity-coated refractory metals as barriers to tritium permeation in elevated temperature (greater than 300°C) structures and (2) investigations of the kinetics of tritium trapping reactions in inert gas purge streams under conditions that emulate fusion reactor environments. Significant results obtained thus far are (1) demonstration of greater than 50-fold reductions in the hydrogen permeability of stainless steel structures by using stainless steel-clad composites containing an intermediate layer of a selected copper alloy and (2) verification that surface-oxide coatings lead to greater than 100-fold reduc-

tions in the hydrogen permeability of vanadium, but that severe oxygen penetration and embrittlement of the vanadium occur at temperatures in the range from 300 to 800°C and under conditions of extremely low oxygen potential. Other considerations pertaining to the large-scale use of metal composites in fusion reactors are discussed, and progress in efforts to demonstrate the fabricability of metal composites is reviewed. Also presented are results of studies of the efficiencies of (1) CuO and CuO-MnO_2 beds in converting HT to HTO and (2) magnesium metal beds in converting HTO to HT. (auth)

9057 (CONF-751125-67) 120 kA PULSED DC POWER SYSTEM WITH COMPUTERIZED THYRISTOR TRIGGERING. Mosko, S. W.; Bates, D. D.; Bigelow, R. R.; Cottongim, E. K.; Pipes, E. W.; Sueker, K. (Oak Ridge National Lab., Tenn. (USA)). 1975. 17p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A pulsed dc power system provides 120 kA excitation current for the ORMAK toroidal field coils. A drive potential of 1000 volts brings the coils up to full current in about 0.5 seconds. Constant current is maintained for 0.25 seconds, then approximately 20 x 10^6 joules of stored energy is dumped in a free-wheeling diode and resistance network. The power system contains 8 each, 30 kA, 500 V thyristor controlled dc power modules in a series/parallel combination. A control computer generates thyristor trigger pulses in a programmed sequence as required for the desired duty cycle. A feedback network including current sensing and computer software permits trigger timing adjustments as necessary for constant current operation. (auth)

9058 (CONF-751125-70) PARTICLE EMISSION FROM POLYCRYSTALLINE AND MONOCRYSTALLINE NIOBIUM UNDER 14.1 MeV NEUTRON IMPACT. Kaminsky, M.; Das, S. K. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 6p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A brief review of recent results on particle emission from cold-rolled and annealed niobium with coarse surface finishes, and from monocrystalline niobium surfaces under 14.1-MeV neutron impact is given. For the cold-rolled and annealed samples two types of deposits were discovered on collector surfaces facing the irradiated targets. One type appeared as a fractional atom layer covering the surface, the other in the form of chunks. No chunk emission was observed for the monocrystalline niobium surface. The chunk deposits on the collectors facing the cold-rolled samples are not uniformly distributed over the collector area but are clustered along certain streaks or appear in patches. Furthermore, the number of chunks per unit collector area and the average chunk size were larger for the rough, cold-rolled samples than for the annealed samples. These observations suggest that the release of stresses (e.g. stresses caused by cold-rolling) in the surface regions by the energy deposited by primary recoils, and surface roughness affect the chunk emission significantly. Previously reported crude estimates of sputtering yields were improved on the basis of information which has become available from additional neutron irradiation runs. (auth)

9059 (CONF-751125-71) X-RAY IMPACT INDUCED DESORPTION OF GASES FROM STAINLESS STEEL SURFACES. Brumbach, S.; Kaminsky, M. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 8p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

During the operation of plasma devices the interaction of energetic photons with surfaces can cause gas release by photodesorption, and thereby contribute to plasma contamination. Measurements of gases released from stainless steel surfaces were made in an ultrahigh vacuum environment using x-rays characteristic for a tungsten target bremsstrahlung spectrum for electron energies varying from 15 to 50 keV. The predominant gas species observed mass spectrometically are CO_2 (m/e equals 44), CO (m/e equals 28), and O_2 (m/e equals 32). Mean quantum yields for the release of these species from stainless steel were determined. For example, for fresh stainless steel surfaces irradiated by x-rays produced by 50 keV electrons, a mean quantum yield for molecular CO_2 release of 3 x 10^{-4} molecules per photons in a bremsstrahlung spectrum at 50 keV electron energy was observed. Based on such a quantum yield an outgassing rate was determined. (auth)

9060 (CONF-751125-72) REDUCTION OF SURFACE EROSION CAUSED BY HELIUM BLISTERING: COMPARISON BETWEEN VACUUM-CAST AND SINTERED-BERYLLIUM. Das, S. K.; Kaminsky, M. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 5p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The blister formation and the erosion associated with blistering in a vacuum cast beryllium foil and in a foil of sintered beryllium powder have been investigated for irradiation at room temperature and at 600°C with 100 keV $^4He^+$ ions for total doses of 0.5 to 1.0 C cm^{-2}. For room temperature irradiation the blisters in sintered beryllium powder are smaller in size than in vacuum cast beryllium. For irradiation at 600°C large scale exfoliation of blisters was observed for vacuum cast beryllium but only a small amount of exfoliation was seen for sintered beryllium powder. The results show a reduction in erosion rate in sintered beryllium as compared to the erosion rate in vacuum cast beryllium. For room temperature irradiation no erosion rate could be determined for the sintered beryllium foil since no blister exfoliation was observed. For 600°C irradiation the erosion rate for sintered beryllium foil is more than an order of magnitude smaller than for vacuum cast beryllium. (auth)

9061 (CONF-751125-73) IRRADIATION OF GRAPHITE CLOTH AT VARIOUS TEMPERATURES WITH DEUTERONS AND HELIUM IONS. Ekern, R.; Das, S. K.; Kaminsky, M. (Argonne National Lab., Ill.). 1975. Contract W-31-109-Eng-38. 6p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Graphite cloth samples were irradiated with 100 keV deuterons and $^4He^+$ ions at room temperature and at elevated temperatures. Scanning electron microscopy was used to examine the surfaces of irradiated and unirradiated graphite fibers. Irradiation at room temperature with $^4He^+$ to a total dose of 3.1 x 10^{18} ions cm^{-2} produces considerable flaking of individual fibers, which is not observed on unirradiated fibers. Identical irradiations at 400° and 800° with $^4He^+$ did not produce any detectable flaking or other surface damage. The elevated temperatures apparently prevent an accumulation of helium in localized areas which in turn could cause flaking in near surface regions. Results obtained for deuteron bombardment of graphite cloth at room temperature and at 600°C are also discussed. (auth)

9062 (CONF-751125-74) SUPERCONDUCTING COIL PROTECTION. Woods, E. L. (Oak Ridge National Lab., Tenn. (USA)). 1975. 6p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The protection system is based on a two-phase construction program. Phase I is the development of a reliable hardwired relay control system with a digital loop utilizing firmware and a microprocessor controller. Phase II is an expansion of the digital loop to include many heretofore unmonitored coil variables. These new monitored variables will be utilized to establish early quench detection and to formulate confirmation techniques of the quench detection mechanism. Established quench detection methods are discussed and a new approach to quench detection is presented. The new circuit is insensitive to external pulsed magnetic fields and the associated induced voltages. Reliability aspects of the coil protection system are discussed with respect to shutdowns of superconducting coil systems. Redundance and digital system methods are presented as related topics. (auth)

9063 (CONF-751125-75) DESIGN OF AN EPR BLANKET. Bettis, E. S.; Huxford, T. J.; McAlees, D. G.; Santoro, R. T.; Watts, H. L.; Williams, M. L. (Union Carbide Corp., Oak Ridge, Tenn. (USA), Nuclear Div.). 1975. 13p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A blanket concept is presented which meets typical requirements anticipated for an Experimental Power Reactor. Design alternatives are reviewed. One-dimensional neutronic and thermal hydraulic results are presented for the ORNL reference design. Design consideration was given for remote maintenance and assembly requirements. Modifications of the reference design first wall are necessary because of high thermal stresses. (auth)

9064 (LA-6044-PR) LASL CONTROLLED THERMONUCLEAR RESEARCH PROGRAM. Progress Report, January--December 1974. Ribe, F. L. (comp.). (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1975. Contract W-7405-ENG-36. 236p. Dep. NTIS $7.60.

Separate abstracts were prepared for the fourteen included sections. (MOW)

For abstracts of individual sections see: 9009–9012, 9023, 9045, 9046, and 9065–9071.

9065 (LA-6044-PR, pp 3-30) SCYLLAC FULL TORUS EXPERIMENTS. Cantrell, E. L.; Ellis, W. R.; Freeman, B. L. Aug 1975.

In LASL Controlled Thermonuclear Research Program. Prog-

ress report, January–December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)).

A review is given of the Scyllac experiment to study methods of producing stable high-beta plasma equilibrium and confinement in a high-beta, stellarator toroidal geometry. Magnetic field measurements are briefly discussed. Some diagnostic apparatus and measurement results are described. (MOW)

9066 (LA-6044-PR, pp 54-58) SCYLLA IV-P THETA PINCH. Quinn, W. E.; Bailey, A. G.; Chandler, G. I.; Hansborough, L. D.; Lillberg, J. W.; Machalek, M. D.; Seibel, F. T. Aug 1975.

In LASL Controlled Thermonuclear Research Program. Progress report, January–December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)).

The Scylla IV-P is a flexible, linear experiment to support the toroidal Scyllac experiments and to investigate high-density, linear theta-pinch concepts. The experimental arrangement and construction status are described. (MOW)

9067 (LA-6044-PR, pp 58-80) SCYLLA I-B/C. McKenna, K. F.; Freese, K. B.; Jahoda, F. C.; York, T. M.; Zimmermann, E. L. Aug 1975.

In LASL Controlled Thermonuclear Research Program. Progress report, January–December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)).

The object of the Scylla I-B implosion heating experiment is to study the implosion process over a range of E/sub theta/'s and initial fill densities characteristic of past and present Scylla-type theta pinches. Ionization and implosion processes are discussed. Some plasma measurements on Scylla I-C are also reported. (MOW)

9068 (LA-6044-PR, pp 145-157) CTR ENGINEERING. Kemp, E. L.; Banta, J. J.; Barnes, G. A. Aug 1975.

In LASL Controlled Thermonuclear Research Program. Progress report, January–December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)).

The power supplies for full torus operation are described. Some capacitor gap failures are discussed. The feedback stabilization system is mentioned. Some power supply problems for Scylla IV-P, toroidal z pinch, and the Scyllac fusion test reactor are described. (MOW)

9069 (LA-6044-PR, pp 158-166) MAGNETIC ENERGY TRANSFER AND STORAGE (METS). Williamson, K. D.; Bailey, A.; Blevins, D. J. Aug 1975.

In LASL Controlled Thermonuclear Research Program. Progress report, January–December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)).

During the past year significant progress has been made toward the goal of providing superconducting magnetic energy storage for plasma compression in the next generation of THETA-pinch experiments. The METS energy storage system will provide the primary energy for the compression coils in Scyllac Fusion Test Reactor (SFTR) and the staging energy requirements for the Experimental Power Reactor (EPR) torus and DEMO plant. In addition, this work will have application to other CTR programs such as ohmic heating in tokamak experiments and possible power supplies for laser flash lamps in the laser fusion program. The current program is developing the necessary components to accomplish this and will culminate in a demonstration METS-SFTR coupled superconducting prototype system. (auth)

9070 (LA-6044-PR, pp 167-212) FUSION TECHNOLOGY. Krakowski, R. A.; Booth, L.; Bosler, G. E. Aug 1975.

In LASL Controlled Thermonuclear Research Program. Progress report, January–December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)).

The Fusion Technology task assesses the long-range technological requirements of fusion power derived from high-beta confinement concepts. The effort includes theoretical analyses and plasma engineering, neutronic studies, nuclear data assessment, electrical insulator and structural alloy research, and general engineering; progress within each of these areas is summarized herein. On the basis of a conceptual engineering design of a Reference Theta Pinch Reactor (RTPR) an environmental impact study has been completed and a technological assessment is near completion. The Fusion Technology task has also supported engineering design activities for the Scyllac Fusion Test Reactor in the areas of tritium handling, radiation shielding, materials, vacuum technology and environmental/safety analyses. Preliminary design studies of a Linear Theta-Pinch Hybrid Reactor (LTPHR) have commenced, and more detailed design studies of this fission/fusion concept are proceeding. (auth)

9071 (LA-6044-PR, pp 213-221) SCYLLAC FUSION TEST REACTOR DESIGN. Dudziak, D. J.; Gerstl, S. A.; Houck, D. L.; Jalbert, R. A.; Krakowski, R. A.; Linford, R. K.; McDonald, T. E.; Rogers, J. D.; Thomassen, K. I. Aug 1975.

In LASL Controlled Thermonuclear Research Program. Progress report, January–December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)).

A general design of the system is given. The implosion heating and compression systems (METS) are described. Tritium handling, shielding and activation of the reactor, and safety and environmental aspects are discussed. (MOW)

9072 (LA-6118-MS) APPLICATION OF SENSITIVITY ANALYSIS TO A QUANTITATIVE ASSESSMENT OF NEUTRON CROSS-SECTION REQUIREMENTS FOR THE TFTR: AN INTERIM REPORT. Gerstl, S. A. W.; Dudziak, D. J.; Muir, D. W. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1975. Contract W-7405-ENG-36. 43p. Dep. NTIS $4.00.

A computational method to determine cross-section requirements quantitatively is described and applied to the Tokamak Fusion Test Reactor (TFTR). In order to provide a rational basis for the priorities assigned to new cross-section measurements or evaluations, this method includes quantitative estimates of the uncertainty of currently available data, the sensitivity of important nuclear design parameters to selected cross sections, and the accuracy desired in predicting nuclear design parameters. Perturbation theory is used to combine estimated cross-section uncertainties with calculated sensitivities to determine the variance of any nuclear design parameter of interest. (auth)

9073 (LA-UR-75-2150) SOME PROPERTIES OF CASTOR OIL AFFECTING ITS PERFORMANCE AS A CAPACITOR IMPREGNANT AND THEIR SIGNIFICANCE TO FUTURE IMPREGNANT RESEARCH. Boicourt, G. P. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 7p. (CONF-751125-50). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

For a considerable time castor oil and polychlorinated biphenyl (PCB) have been the principal impregnants used in energy-storage capacitors. Castor oil has proven to be better than PCB for pulsed applications. PCB's have come under attack as an environmental hazard, while castor oil is a vegetable product and its supply and quality are subject to fluctuation. These two facts make the development of new impregnants desirable. The properties of PCB as a capacitor impregnant are well known. This paper first compares a number of properties of castor oil and PCB's. A comparison is made between the lives of castor oil capacitors and comparable PCB energy-storage capacitors. Some of the physical and chemical properties of castor oil which make it a good pulse capacitor impregnant are examined. These properties can be used as a guide for future research on new pulse capacitor impregnants. (auth)

9074 (LA-UR-75-2151) SYSTEM DESIGN OF THE LOS ALAMOS SCIENTIFIC LABORATORY'S STAGED THETA PINCH. Hammer, C. F.; Thomas, K. S.; Borkenhagen, W. H.; Dike, R. S.; Banta, J. J.; Gribble, R. F.; Linford, R. K. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 8p. (CONF-751125-49). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The Los Alamos Scientific Laboratory's staged theta pinch (STP) is the most recent theta pinch to be constructed at Los Alamos. The intent of the experiment is to provide programmable magnetic fields so that the initial implosion heating and compression of the theta-pinch plasma can be accomplished by the use of separate capacitor banks. The STP is a 4.5-m-long linear theta pinch, the discharge tube diameter is 20 cm. The system consists of five separate and independent capacitor banks, a 75-kV preionization bank, two 125-kV pulse-forming banks, a 700-kJ, 50-kV staging bank, and a 75-kV staging crowbar bank. A description is given of the STP electrical system and the mechanical design. Some of the unique components and techniques developed so this experiment could be built are described. (auth)

9075 (LA-UR-75-2152) MULTICHANNEL SPARK-GAP TECHNOLOGY FOR STAGED THETA-PINCH MACHINES. Borkenhagen, W. H.; Gribble, R. F.; Hansborough, L. D.; Linford, R. K.; Melton, J. G.; Nunnally, W. C. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 5p. (CONF-751125-48). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Triggered multichannel switches operating at voltages up to 180 kV with inductances of 10 to 15 nH have been developed for the staged theta-pinch machines at LASL. These multichannel devices, depending upon their design, can switch up to 30 kJ per switch with peak currents up to 1 MA. The designs of the various spark-gap configurations are discussed from a mechanical and an electrical

viewpoint. The switching modes including crowbar, high-voltage start, and high-voltage holdoff low-voltage start, as well as the experimentally determined triggering characteristics, are also discussed. (auth)

9076 (MLM-2259) EVALUATION STUDY OF THE TRITIUM-HANDLING REQUIREMENTS OF A TOKAMAK EXPERIMENTAL POWER REACTOR. Wittenberg, L. J.; Bixel, J. C.; Braun, J. D., Hobrock, D. L.; Kershner, C. J.; Miles, J. C.; Rhinehammer, T. B.; Watkins, R. A.; Wilkes, W. R. (Mound Lab., Miamisburg, Ohio (USA)). Nov 1975. Contract E-33-1-GEN-53. 32p. Dep. NTIS $4.00.

This report is a Mound Laboratory evaluation study of the tritium handling and containment technology common to all Tokamak Experimental Power Reactor (EPR) conceptual designs. The EPR is assumed to be fueled with a 50/50 deuterium-tritium mixture and to produce thermal power in the 150 to 450 MW range with mechanical power achieved by a steam turbine. The structure will be fabricated principally with stainless steel and no tritium breeding is anticipated during the initial operation. The necessary plant systems and associated administrative control requirements that are discussed include the plasma fuel and exhaust systems, the blanket and coolant system, the plant containment system, tritium accountability, and construction and operation of the reactor facility. (auth)

9077 (TID-26937) PROGRAM FOR DEVELOPMENT OF HIGH-FIELD SUPERCONDUCTING MAGNETS FOR FUSION RESEARCH. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Apr 1975. 87p. Dep. NTIS $7.75.

Three superconducting magnet programs at LLL are outlined. The first program, the one considered in greatest detail, is a developmental program in which LLL will work closely with superconductor manufacturers to develop multifilamentary Nb_3Sn superconductor suitable for use in large CTR magnets. The result of this program will be the fabrication of a rather large magnet (but one that is much smaller than future CTR magnets) and the determination of its performance limitations. In the second program, the developed multifilamentary Nb_3Sn superconductor will be used to construct the magnets for the Fusion Engineering Research Facility (FERF) machine. In this program, the bulk of the effort will be in magnet design and winding. The third program chronologically overlaps the first two programs. This program includes the fabrication and testing of the superconducting magnets for the MX machine although, as explained in the Technical Plan, only the cost of the development work is included in this document. At the present time, Nb–Ti superconductor is being considered. Apart from some initial conductor design work, the major effort will be in magnet design and winding. (auth)

9078 (UCRL-50031-75) SUPERCONDUCTING MAGNET DEVELOPMENT PROGRAM PROGRESS REPORT, JULY 1974–JUNE 1975. Cornish, D. N.; Harvey, A. R.; Nelson, R. L.; Taylor, C. E.; Zbasnik, J. P. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 24 Oct 1975. Contract W-7405-Eng-48. 123p. Dep. NTIS $5.45.

During FY 1975, the superconducting magnet development program at the Lawrence Livermore Laboratory was primarily directed toward the development of multifilamentary Nb_3Sn conductor for large CTR machines. It was secondarily concerned with preliminary work for the MX experiment and with the acquisition of additional testing facilities. Among the significant achievements was the construction and operation of a 27-cm-bore coil to its short-sample limit of 7-T at the windings. The coil was wound with a 100-m length of 67,507-filament Nb_3Sn conductor. (auth)

9079 (UCRL-77042) LOW POWER MULTIPLE SHELL FUSION TARGETS FOR USE WITH ELECTRON AND ION BEAMS. Lindl, J. D.; Bangerter, R. O. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Oct 1975. 36p. (CONF-751108-17). Dep. NTIS $5.50.

From 1st international topical conference on electron beam research and technology; Albuquerque, New Mexico, USA (3 Nov 1975).

Use of double shell targets with a separate low Z, low density ablator at large radius for the outer shell, reduces the focusing and power requirements while maintaining reasonable aspect ratios. A high Z, high density pusher shell is placed at a much smaller radius in order to obtain an aspect ratio small enough to protect against fluid instability. Velocity multiplication between these shells further lowers the power requirements. Careful tuning of the power profile and intershell density results in a low entropy implosion which allows breakeven at low powers. Ion beams appear to be a promising power source and breakeven at 10–20 Terrawatts with 10 MeV alpha particles appears feasible. Predicted performance of targets with various energy sources is shown and comparison is made with single shell targets. (auth)

9080 (UCRL-77048) STABILITY AND SYMMETRY REQUIREMENTS OF ELECTRON AND ION BEAM FUSION TARGETS. Bangerter, R. O.; Lindl, J. D.; Max, C. E.; Mead, W. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Oct 1975. 37p. (CONF-751130-6). Dep. NTIS $4.50.

From ASP meeting; St. Petersburg, Florida, USA (10 Nov 1975).

Considerations of hydrodynamic stability impose severe restrictions on the design of electron and ion beam imploded fusion targets. Furthermore, in order to obtain a sufficiently spherical implosion, many target designs require electron or ion beams having a high degree of spherical symmetry. The stability and symmetry requirements of several recently proposed target designs were studied by numerical simulation using the computer program LASNEX. The ion beam targets studied are more vulnerable to instability than the electron beam targets. (auth)

9081 (UCRL-77465) CONTROLLED FUSION PHYSICS: EXPERIMENTAL. Post, R. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Oct 1975. 14p. (CONF-751130-4). Dep. NTIS $4.50.

From ASP meeting; St. Petersburg, Florida, USA (10 Nov 1975).

A historical review is given of the experimental thermonuclear research program. The role of pinch devices, mirror machines, tokamak devices, and laser fusion is discussed. (MOW)

9082 (UCRL-Trans-10940) FUSION REACTORS AS A FUTURE ENERGY SOURCE. Seifritz, W. Translated from Schweiz. Ver. Atomenerg., Bull.; No. 10, vp(1975). 60p. Dep. NTIS $6.00.

A detailed update of fusion research concepts is given. Discussions are given for the following areas: (1) the magnetic confinement principle, (2) UWMAK I: conceptual design for a fusion reactor, (3) the inertial confinement principle, (4) the laser fusion power plant, (5) electron-induced fusion, (6) the long-term development potential of fusion reactors, (7) the symbiosis between fusion and fission reactors, (8) fuel supply for fusion reactors, (9) safety and environmental impact, and (10) accidents, and (11) waste removal and storage. (MOW)

9083 LASER-IGNITED NUCLEAR FUSION. Mulser, P. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Kerntechnik; 17: No. 6, 260-265(Jun 1975). (In German, English).

5 figs.; 19 refs.

High power lasers open a new way for achieving controlled nuclear fusion. Classic fusion research is aimed at confining low density plasmas for as long as possible by means of magnetic fields. In a laser-ignited fusion reactor, by contrast, matter is compressed within a very short time to the highest possible density and is concurrently heated until the entire compressed volume ignites. The fusion reactions then proceed so fast that inertial forces alone are sufficient to hold matter together for a sufficiently long time without the aid of magnetic fields. This paper presents the results of detailed calculations in this field, reports on the current status of the research work and discusses various relevant problems. (auth)

9084 FUSION REACTOR. Genswein, A. German(FRG) Patent 2,350,012/A/. 17 Apr 1975. 7p. (In German).

9 figs.

The invention relates to a pulsed D-T fusion reactor with a toroidal configuration. It is characterized by a torus consisting of several concave, curved tank and winding sections and annular coils which generate a magnetic field spreading mainly along the tank wall and closed in itself, the density of which decreases in the direction of the core of the torus. The annular coils are shorted superconducting magnet coils. The D-T plasma is heated by induction by an independent quick discharge of iron-cored inductors previously magnetized. Additional detailed patent claims are expressed in a number of diagrams attached to the patent application. (GE)

9085 MEASUREMENT OF THE ION TEMPERATURE IN LASER-DRIVEN FUSION. Slivinsky, V.W.; Ahlstrom, H.G.; Tirsell, K.G.; Larsen, J.; Glaros, S.; Zimmerman, G.; Shay, H. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Rev. Lett. 35: No. 16, 1083-1085 (20 Oct 1975).

Using the time-of-flight technique, energy distribution measurements were made of the α particles emitted from laser implosions of DT gas in glass microshells. The number of nuclear reactions was determined by an absolute measurement of the number of α particles. From the width of the energy distributions, upper limits of the plasma ion temperature have been inferred. (auth)

9086 DETECTION OF CORE-GAS IONS FROM ^{3}He-FILLED PELLETS IN LASER-DRIVEN FUSION STUDIES. Goforth, R.R. (KMS Fusion, Incorporated, Ann Arbor, Michigan 48106). Appl. Phys. Lett. 27: No. 11, 598-600 (1 Dec 1975).

$^3He^{2+}$ ions from laser-irradiated ^{3}He-filled glass microsphere targets were mass spectroscopically observed only at low velocities consistent with the predictions of hydrodynamic calculations. The null measurements at high velocity indicate that the core gas is largely contained. (auth)

9087 USEFUL ENERGY FROM THERMONUCLEAR REACTORS. Kapitza, P.L. (Institute of Physics Problems, USSR Academy of Sciences). JETP Lett. 22: No. 1, 9-11 (5 July 1975).

The necessary conditions are indicated for obtaining useful energy from thermonuclear devices in which the ions are heated by energy transfer through Coulomb collisions with electrons. It is shown that this principle can be used to produce a reactor that employs the plasma pinch, described by the author in earlier papers, based on the reaction of deuterium with tritium. The time of the necessary plasma containment in pulsed installations with such an ion-heating method is estimated. (auth)

9088 WHITE-LIGHT INTERFEROMETRIC MEASUREMENT OF THE WALL THICKNESS OF HOLLOW GLASS MICROSPHERES. Weinstein, B.W. (University of California, Lawrence Livermore Laboratory, Livermore, California 94550). J. Appl. Phys. 46: No. 12, 5305-5306 (Dec 1975).

A simple interferometric technique using both a white-light and a monochromatic-light source can be used to measure the wall thickness of hollow glass microspheres to better than 0.05 μm. The entire procedure requires only a few minutes per sphere and can easily be made to take into account the effects of any gas with which the ball is filled. (auth)

9089 CULHAM SUPERCONDUCTING LEVITRON. Skellett, S. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). Cryogenics; 15: No. 10, 563-568(Oct 1975).

The evolution of high energy plasma confinement systems culminating in a system, the levitron, which utilizes a superconducting levitated ring to trap the plasma, is traced. The stability, handling and the specifications of the Culham ring is described and the design details of the cryogenic support structure, the refrigerator system and the liquid nitrogen circulating system of the system, are given. Operational experience already obtained on the machine is discussed. (UK)

9090 APPARATUS FOR PRODUCING LASER TARGETS. Jarboe, T. R.; Baker, W. R. (to U. S. Energy Research and Development Administration). US Patent 3,907,477. B29C17/14; B21C29/00. 23 Sep 1975. Filed date 26 Feb 1974. 8p.

PAT-APPL-446,066.

This patent relates to an apparatus and method for producing deuterium targets or pellets of 25u to 75u diameter. The pellets are sliced from a continuously spun solid deuterium thread at a rate of up to 10 pellets/second. The pellets after being sliced from the continuous thread of deuterium are collimated and directed to a point of use, such as a laser activated combustion or explosion chamber wherein the pellets are imploded by laser energy or laser produced target plasmas for neutral beam injection. (auth)

9091 ELECTRON BEAM DEVICE. Beckner, E. H.; Clauser, M. J. (to U. S. Energy Research and Development Administration). US Patent 3,899,681. G21b1/00. 12 Aug 1975. Filed date 1 Apr 1974. 6p.

PAT-APPL-457,673.

This patent pertains to an electron beam device in which a hollow target is symmetrically irradiated by a high energy, pulsed electron beam about its periphery and wherein the outer portion of the target has a thickness slightly greater than required to absorb the electron beam pulse energy. (auth)

Wave Phenomena

9092 (EUR-CEA-FC-770) PARAMETRICALLY UNSTABLE ION SOUND WAVES. Canobbio, E. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Grenoble, 38 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de la Physique du Plasma et de la Fusion Controlee). May 1975. 22p. INIS.

The dispersion relation is derived for parametric instabilities caused by an intense ion sound wave which couples high and low frequency electrostatic modes of a non isothermal unmagnetized homogeneous plasma. The phase velocity of the pump wave is between the ion and the electron thermal speed. The dispersion relation contains filamentational, modulational, and stimulated scattering instabilities. Growth rates as a function of the pump and plasma characteristics are given. For a given amplitude of the pump $/PHI_0/$, the largest growth rate is found in the case of filamentation instability, which becomes explosive in nature when $/ePHI_0/^2/\ T_i T_e = (k\ \lambda(D))^2$, where $\lambda(D)$ is the Debye length. The physical situation studied allows to clarify some new basic parametric processes occurring during R.F. heating below and around the ion gyrofrequency. Finally, the relevance of this and other more general parametric instabilities from the point of view of plasma heating and confinement, is briefly discussed. (FR)

9093 LIMITATION OF BRILLOUIN SCATTERING IN PLASMAS. Kruer, W.L.; Valeo, E.J.; Estabrook, K.G. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Rev. Lett. 35: No. 16, 1076-1079 (20 Oct 1975).

It is shown that Brillouin scattering of intense laser light in plasmas can be limited by momentum and energy deposition as a result of reflection of the light. The calculations compare favorably with some recent experimental results. (auth)

9094 EFFECTIVE COLLISION FREQUENCY IN THE PRESENCE OF AN ION SOUND WAVE PARAMETRICALLY EXCITED IN TONKS-DATTNER RESONANCE. Ikezawa, S. (Department of Electronic Engineering, Chubu Institute of Technology, Kasugai, Japan); Okuda, T. J. Appl. Phys. 46: No. 11, 4730-4739 (Nov 1975).

Effective collision frequency enhanced by an ion sound wave parametrically excited in Tonks-Dattner (T-D) resonance is evaluated from the Q value and the damping rate of a surface wave propagating along the axial direction as a test wave, which are observed in a mercury vapor discharge. The ion sound wave is produced by a three-wave process of the parametric excitation where the incident electromagnetic wave decays into two electrostatic waves, an ion sound wave, and a T-D resonance. The effective collision frequencies thus obtained as a function of the absorbed pumping power are nearly in agreement with those based on the perturbed orbit theory proposed by Weinstock *et al.* The ion density fluctuation level estimated from Dawson's formula is found to be lower than that obtained in other turbulent experiments. (auth)

9095 ON THE CHARACTERISTICS OF A TRANSVERSELY MAGNETIZED PARALLEL-PLANE WAVEGUIDE CONTAINING MOVING PLASMA. Mukherjee, P.K. (Department of Physics and Astrophysics, University of Delhi, Delhi-110007, India). J. Appl. Phys. 46: No. 12, 5292-5293 (Dec 1975).

Some properties of a transversely magnetized parallel-plane waveguide containing moving plasma have been studied. Expressions are obtained for the dispersion relations and the field components for the TE and the TM modes excited in the waveguide. Analytic expressions are also derived for the cutoff frequencies of these modes. It is found that the characteristics of a TE mode remain unaffected by the velocity of the moving medium and the presence of an ambient magnetic field. (auth)

ENGINEERING

Energy Conversion

Refer also to abstract 9416.

Facilities and Equipment

Refer also to abstracts 9468, 9469, and 9909.

9096 (AECL-5234) A FINITE ELEMENT COMPUTER PROGRAM FOR THE CALCULATION OF THE RESONANT FREQUENCIES OF ANISOTROPIC MATERIALS. Fleury, W. H.; Rosinger, H. E.; Ritchie, I. G. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Sep 1975. 62p. Dep. NTIS (US Sales Only) $5.50. AECL $2.00.

A set of computer programs for the calculation of the flexural and torsional resonant frequencies of rectangular section bars of materials of orthotropic or high symmetry are described. The calculations are used in the experimental determination and verification of the elastic constants of anisotropic materials. The simple finite element technique employed separates the inertial and elastic properties of the beam element into station and field transfer matrices respectively. It includes the Timoshenko beam corrections for flexure and Lekhnitskii's theory for torsion-flexure coupling. The programs also calculate the vibration shapes and surface nodal contours or Chladni figures of the vibration modes. (auth)

9097 (CEA-CONF-3008) SHORT CHANNEL MOSFET MODELING. Gautier, J.; Borel, J.; Merckel, G. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. d'Electronique et de Technologie de l'Informatique). 3 Feb 1975. 17p. INIS.

From 4th European solid state device research conference (ESSDERC 74); Nottingham, UK (16 Sep 1974).

The reasons for trying to decrease MOSFET device dimensions are briefly recalled. Theoretical and experimental results obtained for micron MOSFETS are then presented. (FR)

9098 (SAND-75-0412) ELECTROMAGNETIC ENVIRONMENTS SIMULATOR (EMES). Varnado, G. B. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1975. Contract AT(29-1)-789. 112p. Dep. NTIS $5.45.

A multipurpose electromagnetic environments simulator has been designed to provide a capability for performing EMR, EMP, and lightning near stroke testing of systems, subsystems and components in a single facility. This report describes the final facility design and presents the analytical and experimental verification of the design. (auth)

9099 (STI/PUB-402) RADIATION FOR A CLEAN ENVIRONMENT. Proceedings Series. Proceedings of the International Symposium Held in Munich, Germany, March 17-21, 1975. (International Atomic Energy Agency, Vienna (Austria)). Aug 1975. 682p. (In Russian and English). (CONF-750316-). IAEA $41.00.

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975).

Forty-eight papers on the use of high-level radiation in treating municipal and industrial wastes were presented at the conference. A separate abstract was prepared for each of 43 papers. Three of the papers are also announced in ERDA Research Abstracts (ERA). The remaining papers were not in scope for NSA or ERA. (LCL)

For abstracts of individual papers see: 8947–8973, 9102–9111, and 9465–9470.

9100 FAILURE RESEARCH REPORT. Failures in Welded Joints of Pressure Parts in Power Plant Construction. Heinz, A. (Allianz Versicherungs-A. G., Muenchen (F. R. Germany). Abt. Technische Verischerungen); Schueller, H. J. (Allianz-Zentrum fuer Technik G.m.b.H. (AZT), Ismaning/Muenchen (F. R. Germany)); Woitscheck, A. (Allianz-Zentrum fuer Technik G.m.b.H. (AZT), Ismaning/Muenchen (F. R. Germany). Fachgruppe Metallkunde). Maschinenschaden; 47: No. 5, 179-186(1975). (In German)

From meeting on welding techniques 1974; Muenchen, F. R. Germany (11 Sep 1974). 15 figs.; 8 refs.

By the example of an unusual failure case on a superheater tube of a steam generator, the authors point out the disadvantageous results that carelessly performed assembly weldings can lead to. (GE)

9101 APPARATUS FOR BLENDING SMALL PARTICLES. Bradley, R. A.; Reese, C. R.; Sease, J. D. (to U. S. Energy Research and Development Administration). US Patent 3,901,409. B67D5/60. 26 Aug 1975. Filed Date 23 Jul 1974. 6p. PAT-APPL-491,096.

An apparatus is described for blending small particles and uniformly loading the blended particles in a receptacle. Measured volumes of various particles are simultaneously fed into a funnel to accomplish radial blending and then directed onto the apex of a conical splitter which collects the blended particles in a multiplicity of equal subvolumes. Thereafter the apparatus sequentially discharges the subvolumes for loading in a receptacle. A system for blending nuclear fuel particles and loading them into fuel rod molds is described in a preferred embodiment. (auth)

9102 ALTERNATIVE HIGH-LEVEL RADIATION SOURCES FOR SEWAGE AND WASTE-WATER TREATMENT. Ballantine, D. S. (Energy Research and Development Administration, Washington, DC). pp 309-323 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

The choice of an energy source for the radiation treatment of waste-water or sludge is between an electron accelerator or a gamma-ray source of radioactive cobalt or cesium. A number of factors will affect the ultimate choice and the potential future adoption of radiation as a treatment technique. The present and future availability of radioactive sources of cobalt and cesium is closely linked to the rate of nuclear power development and the assumption by uranium fuel reprocessors of a role as radioactive cesium suppliers. Accelerators are industrial machines which could be readily produced to meet any conceivable market demand. For energy sources in the 20 to 30 kW range, electron accelerators appear to have an initial capital cost advantage of about seven and an operating cost advantage of two. While radioisotope sources are inherently more reliable, accelerators at voltages to 3 MeV have achieved a reliability level adequate to meet the demands of essentially continuous operations with moderate maintenance requirements. The application of either energy source to waste-water treatment will be significantly influenced by considerations of the relative penetration capability, energy density and physical geometrical constraints of each option. The greater range of the gamma rays and the lower energy density of the isotopic sources permit irradiation of a variety of target geometrics. The low penetration of electrons and the high-energy density of accelerators limit application of the latter to targets presented as thin films of several centimeters thickness. Any potential use of radiation must proceed from a clear definition of process objectives and critical comparison of the radiation energy options for that specific objective. (auth)

9103 HIGH-POWER ELECTRON BEAM RADIATION FOR THE TREATMENT OF MUNICIPAL AND INDUSTRIAL WASTES. Cleland, M. R.; Farrell, J. P.; Malnati, R. L.; Morganstern, K. H. (Radiation Dynamics, Inc., Westbury, NY). pp 325-342 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

One of the factors impeding the use of ionizing radiation for waste treatment has been the relatively high cost of large radiation sources. This obstacle has been reduced by the recent development of powerful electron beam accelerators that are now being used by many manufacturers to crosslink plastic and rubber compounds, and to sterilize ethical products. The industrial demand for radiation processing equipment has produced a new technology which can be applied to the irradiation of waste materials. Electron accelerators can now provide 150 kW of useful beam power for continuous service. Such machines could process 3.1 MGD (million US gallons daily) of water to an average dose of 0.1 Mrad. The unit cost for the radiation process would be about $0.22 per 1000 gallons. Larger systems delivering up to a megawatt of power could be developed within a few years if needed for large-scale applications. Such equipment would bring the radiation processing cost down still further and would increase the capacity to about 22 MGD. This throughput would be comparable with the waste water effluent of large sewage treatment plants in the New York City area. High-power electron beams may be particularly useful in the treatment of gaseous wastes. The irradiation of stack gases from large electric power stations, a process that is now being investigated in Japan, is a possible application that could justify the development of multi-megawatt electron beam systems. (auth)

9104 PROSPECTS FOR HIGH-ENERGY ELECTRON IRRADIATION OF WASTE-WATER LIQUID RESIDUALS. Trump, J. G.;

Wright, K. A.; Merrill, E. W.; Sinskey, A. J.; Shah, D.; Sommer, S. (Massachusetts Inst. of Tech., Cambridge). pp 343-354 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

The proposal by the Massachusetts Institute of Technology to set up at Boston's MDC waste-water treatment plant a high-energy electron research facility for studies primarily on the pasteurization of municipal sludge is described. Powered by a commercial 50 kW electron accelerator the compact outdoor concrete-shielded system could treat 100 kilogallons (400 m^3) daily of selected materials to a dose of 400 kilorads. The proposal follows extensive work at M.I.T. on electron beam applications to science and medicine and one year of NSF-RANN supported studies on disinfection of sludge. The penetration, irradiation time, safety, flexibility and availability of the ionizing energy produced by electron accelerators is contrasted with that from ^{60}Co and ^{137}Cs. Preliminary estimates of costs for a 100 kgal/day electron treatment module and based on assumed dose and efficiency values are given. (auth)

9105 ELECTRON ACCELERATOR WITH ELECTRONS OF LOW-ACCELERATING VOLTAGE FOR IRRADIATION SEWAGE SLUDGE AND WASTE-WATER. Holl, P. (Polymer-Physik GmbH and Co. KG, Tuebingen, Ger.); Schneider, J. pp 355-358 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Large-scale irradiation of sewage sludge and waste-water with ionizing beams depends mainly on cheap, simple and sturdy electron beam sources. An accelerator with high-vacuum insulation and an operating voltage of 400 kV is described, based on the approved technique of beam generation in electron beam welding machines. The high-voltage strength of the accelerator is achieved by the interposing of screen cylinders maintained on definite potentials by resistors. A simple and cheap replacement of cathodes, connected with a vacuum system of a high air pumping speed, make this type of beam generator a tool easy to handle. Pressure gas for insulating the high voltage is not required. (auth)

9106 PRACTICAL ASPECTS OF THE PASTEURIZATION OF SEWAGE SLUDGE BY ELECTRON IRRADIATION. Tauber, M.; Hofmann, E. G.; Offermann, B. P. (AEG-Telefunken, Hamburg). pp 359-366 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Recently the demand for disinfection of sewage sludge has increased. Investigations have shown that the radiation pasteurization of sludge is the most preferable treatment. Up to now most of these investigations have been made with ^{60}Co radiation sources. However, it is not easy to run an economic and safe process line for the irradiation of sewage sludge with such isotope sources. Powerful electron accelerators are now available and the main features of the irradiation of sewage sludge with fast electrons are discussed and the design parameters of such installations described. From the standpoint of the limited electron penetration into the material it is desirable to use high-energy electrons (up to 1.5 MeV) whereas from an economic standpoint it may be better to use electrons of lower energies (0.5 to 1 MeV) and to homogenize the sewage sludge to the required thickness. The following parameters must be considered for a commercial process line: effectivity of the electron radiation process; limited penetration of electrons into the material to be irradiated; beam power of electron accelerators required for sewage sludge treatment; safety aspects; economics of the process with regard to electron energy, power and homogenization of the material; and environmental aspects of the installations. The practical aspects of commercial process lines for electron irradiation of sewage sludge and the design of handling equipment are discussed in relation to these parameters. (auth)

9107 FISSION PRODUCT GAMMA-RAY SOURCES AS AN ALTERNATIVE TO COBALT-60 SOURCES FOR SEWAGE SLUDGE STERILIZATION. Herrnberger, V. R. D. (Swiss Federal Inst. for Reactor Research, Wuerenlingen, Switzerland). pp 367-389 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

The sterilization of sewage sludge is now performed successfully using ^{60}Co gamma-ray sources. The question arises whether more economic gamma-ray sources exist that could replace the ^{60}Co source. The following types of sources are considered: spent fuel elements; mixtures of solidified fission products; and isolated solidified fission products such as $^{134/137}Cs$. For a particular irradiation plant, the specific source costs (S.Fr./Ci) and their contribution to the irradiation costs for 1 m^3 of sewage irradiated to a dose of 250 krad (S.Fr./m^3) are determined and compared with the costs of a plant using a ^{60}Co source. The encapsulation costs and the effect of the gamma absorption of the source are taken into account. Different encapsulation and source management techniques are reviewed to find the most economic for each source type. A spent fuel element irradiation facility is recommended for use either in combination with a sewage water purification plant or as part of a power reactor station where it replaces the storage water pool for the spent fuel elements. Additional source capsules are not envisaged, as long as double-walled source containers are used. The fission product mixtures are enclosed in double-walled capsules of two different forms, i.e., small cylindrical rods and hollow cylinders. For cesium and cobalt cylindrical rods only are used. The main conclusions of the study are that the highest irradiation costs arise from the use of a fission product mixture source. The costs are, however, only 15% above those of a ^{60}Co plant. To be competitive the flow-rate has to be adapted to the decreasing activity of the source, resulting in a reduction to 20% within ten years of source utilization. The integrated irradiation plant with a spent fuel element source offers irradiation costs comparable with those of a ^{60}Co plant, if the flow-rate is constant during one year of source utilization. The irradiation costs are reduced to 25% of those of a ^{60}Co plant, if the flow-rate is proportional to the decreasing source activity. In this case they are the lowest of all source types considered. Further advantages of the integrated irradiation plant are its inherent safety aspects, because additional source handling and transport are avoided. The ^{137}Cs type source is cheaper by 17% and therefore can compete with the ^{60}Co source. The compatibility of the cesium in the form of chloride with the stainless-steel capsules is assured for the 30 years of planned source utilization and plant operation time. Fission product gamma sources offer an alternative to ^{60}Co sources for sewage sludge sterilization, because they are competitive with ^{60}Co sources. (auth)

9108 CONSIDERATIONS IN THE PUBLIC ACCEPTANCE OF SEWAGE SLUDGE IRRADIATION SYSTEMS. Dix, G. P. (Atomic Energy Commission, Washington, DC). pp 399-408 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Considerations associated with public acceptance of municipal sewage sludge irradiation systems are discussed including the benefit to society, public information and safeguards. Public acceptance of products is based upon the benefit to society as measured by reduced consumer costs, minimization of public risk and enhancement of the quality of life and the environment. When viewed in this positive light, the sludge irradiator has high potential benefits to the community. If large-scale engineering experiments show that sludge irradiation is more cost-effective than other methods, reduced consumer costs would result. Today many sewage plants do not consistently remove pathogens from sludge; sludge irradiation could be an effective method of pathogen removal and result in avoidance of a major public risk. The sludge irradiator may be able to clean up recreational areas, reduce noxious odors from sewage treatment facilities, and reduce the energy requirements for producing fertilizer and soil conditioners and conserve their mineral content. Plant safeguards must be explained to dispel public concern that the contents of the source can be released to the sludge accidentally. This will be the main issue within the technical sector of the public, and the design, procedural and administrative safeguards of the plant must be fully explained. The primary risk associated with sludge irradiators will be the remote possibility of source leakage into the sludge. The various safeguards in sludge irradiation plants are discussed in detail including the form of the radionuclide, encapsulation, the irradiation chamber, safeguards instrumentation, shielding and thermal safeguards. (auth)

9109 STUDY OF RADIATION PROCESSES FOR PURIFYING LIQUID EFFLUENT AND THE DESIGN OF PILOT PLANTS. Kon'kov, N. G. (All-Union Scientific Inst. of Radiation and Tech., Moscow); Buslaeva, S. P.; Osipov, V. B.; Panin, Yu. A.; Solodikhina, L. D.; Upadyshev, L. B.; Karpukhin, V. F.; Faingol'd, Z. L. pp 419-431 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975). (In Russian).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

The possibilities of purifying liquid effluents containing dyestuffs and various organic and biological pollutants with an accelerated electron beam of energy up to 0.7 MeV are examined. A laboratory plant has been erected for the stationary, continuous irradiation—with bubbling of air—of artificial and natural industrial effluent containing organic pollutants in concentrations of up to 2 g/liter and the 5 SKh dye in concentrations of up to 220 mg/liter. The results are discussed of the experimental irradiation of artificial mixtures consisting of distilled water, organic pollutants and dyestuffs, and also of natural industrial effluents from an enterprise where antibiotics are produced and from textile mills. The results of the studies indicate that the physicochemical characteristics of effluents are improved. On the basis of these studies pilot plants with electron accelerators are being designed for a daily throughput of 15,000 m^3 of effluent from the production of antibiotics. The electron accelerators are of the transformer type (EhLV-1) with an energy of up to 0.7 MeV and a power of up to 40 kW. In addition, units with a daily throughput of 200 m^3 are being designed for the breakdown of cyanides in effluent by ^{60}Co. Such a unit consists of three reactors with centro-axial irradiators and solid cast-iron biological shielding. The dose-rate can be measured over a wide range, thanks to the use of spherical source holders. The sources have a total activity of 62 kCi. Calculations of the cost of the radiation treatment of effluent demonstrate the economic feasibility of the method. (auth)

9110 EXPERIENCE WITH A PILOT PLANT FOR THE IRRADIATION OF SEWAGE SLUDGE. Design, Operation Experience, and Cost Calculations After 18 Months of Continuous Running. Lessel, T. (Planugs- und Bettiebsbuero Ampergruppe, Eichenau, Ger.); Moetsche, H.; Hennig, E.; Suess, A.; Rosopulo, A.; Schurmann, G. pp 447-464 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

A pilot plant for irradiation of sewage sludge was built in 1972–1973 at the sewage water treatment plant of the Abwasserverband Ampergruppe in Geiselbullach. This plant is intended for a daily capacity of 150 m^3 of sludge, to be irradiated at a dose of 300 krad. For testing purposes this plant has been operated during the last 18 months at a capacity of only 30 m^3 daily. During this period significant alterations to the installation were unnecessary and the experience showed that the plant can be operated economically compared with the heat treatment. Because of the simple design of the plant no specially trained personnel are required. (auth)

9111 DOSIMETRY AT A HIGH-ACTIVITY ^{60}Co WASTE TREATMENT FACILITY. Regulla, D. G. (Gesellschaft fuer Strahlen- und Umweltforschung mbH, Nuremburg); Schurmann, G.; Suess, A. pp 465-476 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

The application of high-level radiation in waste treatment requires correct dosimetry in order to work effectively, safely and economically. Thus, there is the need for routine dosimetry techniques, sufficiently accurate, with detectors both mechanically and chemically resistant and easy to operate, typically covering the dose range up to Mrad. The particular dosimetry problem in the present pilot study performed at a radiation waste treatment facility, using a 150 kCi ^{60}Co source for hygienization of sewage sludge, has arisen from the radiation field being highly discontinuous in dose-rate and unknown with respect to the effective photon energy distribution, thus excluding dose calculations. There was, moreover, difficulty in determining the degree of dose homogeneity over the whole sludge filling and the fact that the dose meters passed a turbo pump. On the basis of a review of the different dosimetry techniques applicable, the discoloration of silver-activated metaphosphate glass has proved to be the most useful method for the present dosimetry program. For purposes of energy-independent reference dosimetry, a TL technique using lithium borate has been elaborated. For control, both systems have been checked against a chemical dose meter on a $FeSO_4$ basis. A description is given of the physical and radiological features of the dose meters applied and reports on the dosimetric results for both calibration and routine measuring conditions. Further, practical experiences are described concerning, for instance, the dose homogeneity, sudden dose decreases, and the influence of the solid content of the sludge on the dose. (auth)

Lasers

Refer also to abstract 9983.

9112 (LA-6124-MS) VERY HIGH INTENSITY REACTION CHAMBER DESIGN. Devaney, J. J. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1975. Contract W-7405-ENG-36. 14p. Dep. NTIS $4.00.

The problem of achieving very high intensity irradiation by light in minimal regions was studied. Three types of irradiation chamber are suggested: the common laser-reaction chamber, the folded concentric or near-concentric resonator, and the asymmetric confocal resonator. In all designs the ratio of high-intensity illuminated volume to other volume is highly dependent (to the $^3/_2$ power). on the power and fluence tolerances of optical elements, primarily mirrors. Optimization of energy coupling is discussed for the common cavity. For the concentric cavities, optimization for both coherent and incoherent beams is treated. Formulae and numerical examples give the size of chambers, aspect ratios, maximum pass number, image sizes, fluences, and the like. Similarly for the asymmetric confocal chamber, formulae and numerical examples for fluences, dimensions, losses, and totally contained pass numbers are given. (auth)

9113 (UCRL-13660) FLUORESCENCE LINE-NARROWING STUDIES OF Nd : GLASS LASER MATERIALS. Riseberg, L. A.; Brecher, C. (GTE Labs., Inc., Waltham, Mass. (USA)). [nd]. Contract W-7405-Eng-48. 51p. (TR-75-029.1). Dep. NTIS $5.50.

The increasing importance of Nd glass lasers in laser fusion technology has emphasized the inadequacy in the understanding of the optical properties of rare earth ions in glasses. Indeed, it has been difficult to generate models for the performance of these devices, and the selection of host glasses could be done by little more than a trial-and-error approach. The technique of laser-induced fluorescence line-narrowing developed within the last few years provides a new and powerful tool for the study of these systems. In this technique, a laser excites within the inhomogeneously broadened absorption bands a selected subgroup of the ions in the system, namely those whose absorption energy is resonant with the laser. If the excitation does not migrate among the entire collection of ions prior to fluorescence, the fluorescence that is observed is only from the group that was excited and is narrowed. This permits the selective study of classes of ion sites within the ensemble. The concept is indicated schematically. By the use of a tunable laser, such as a dye laser, it is possible to vary the class of sites, defined by energy, that is excited and thereby study the important spectroscopic properties and their variations, unclouded by the averaging that occurs under excitation of the entire system. Furthermore, it is then possible to use the spectroscopic information to infer a description of the variation of the microscopic environment, and a rationalization of the effects of compositional changes. Use of a pulsed dye laser and time-resolved detection permits the study of the dynamics, including, for example, the energy transfer among ions of different energies within the inhomogeneously-broadened spectrum. The goal of this project has been to apply such studies to glasses of interest to glass laser technology, providing information for device modeling, and establishing design criteria for glass selection. (auth)

9114 (UCRL-77561) PROCEEDINGS OF THE MEETING FOR COORDINATING PRECISION MACHINING OF OPTICS RESEARCH AND REQUIREMENTS. Saito, T. T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Dec 1975. Contract W-7405-Eng-48. 22p. (CONF-750998-1). Dep. NTIS $4.50.

From meeting for coordinating precision machining of optics; Kirtland AFB, New Mexico, USA (18 Sep 1975).

The meeting for "Coordinating Precision Machining of Optics Research and Requirements" on September 18, 1975, was sponsored by the Air Force Weapons Laboratory at Kirtland AFB, NM. These proceedings contain an introduction to the meeting including a brief description of the participants and the objectives. The developments and capabilities of Union Carbide Y-12 plant are described in detail. A short summary of the new Moore no. 5 machine at Bendix, Kansas City, Mo. is included as well as a description of using light scattering for roughness characterization at Rockwell International, Rocky Flats, Colorado. The executive summary of the meeting mentions some of the discussions that also followed. Important conclusions of the meeting were that a 5 y lead time is required to obtain a machine and acquire the necessary skills for precision machining, and that demands for diamond turning optics will be increasing. (auth)

9115 (Y-DA-6328) OPTICAL MEASUREMENTS OF SURFACE QUALITY AND FIGURE OF DIAMOND-TURNED MIRRORS. Sladky, R. E.; Dean, R. H. (Oak Ridge Y-12 Plant, Tenn. (USA)). 1975. Contract W-7405-eng-26. 17p. (CONF-750748-2). Dep. NTIS $4.50.

From 7th NBS-ONR-ASTM symposium on damage in laser materials; Boulder, Colorado, USA (30 Jul 1975).

During the past year, the Oak Ridge Y-12 Plant has made mirrors, by diamond turning, for the LASL High-Energy Laser and other projects. The largest of these mirrors is flat, elliptical in

shape, and 654 mm (25.5 in) on the major axis and 394 mm (15.5 in) on the minor axis. The concave mirrors are 394 mm OD. These mirrors were inspected for surface finish and figure. In addition, the blur circle was measured. Measurements of scattered light have also been made. In some cases, the diffraction pattern was related to the waves formed in the surface by the machining process. This information has been useful to engineers doing research on the diamond turning of laser materials. (auth)

9116 (Y-DA-6346) SLIDE-POSITION ERRORS DEGRADE MACHINED OPTICAL COMPONENT QUALITY. Arnold, J. B.; Steger, P. J.; Burleson, R. R. (Oak Ridge Y-12 Plant, Tenn. (USA)). 12 Dec 1975. Contract W-7405-eng-26. 27p. (CONF-750748-1). Dep. NTIS $5.00.

From 7th NBS-ONR-ASTM symposium on damage in laser materials; Boulder, Colorado, USA (30 Jul 1975).

An ultraprecision lathe is being developed at the Oak Ridge Y-12 Plant to fabricate optical components for use in high-energy laser systems. The lathe has the capability to produce virtually any shape mirror which is symmetrical about an axis of revolution. Two basic types of mirrors are fabricated on the lathe, namely: (1) mirrors which are machined using a single slide motion (such as flats and cylinders), and (2) mirrors which are produced by two-coordinated slide motions (such as hyperbolic reflectors; large, true-radius reflectors, and other contoured-surface reflectors). The surface-finish quality of typical mirrors machined by a single axis of motion is better than 13 nm, peak to valley, which is an order of magnitude better than the surface finishes of mirrors produced by two axes of motion. Surface finish refers to short-wavelength-figure errors that are visibly detectable. The primary cause of the inability to produce significantly better surface finishes on contoured mirrors has been determined as positional errors which exist in the slide positioning systems. The correction of these errors must be accomplished before contoured surface finishes comparable to the flat and cylinder can be machined on the lathe. (auth)

9117 SURFACE TREATMENT OF THE Al COLD CATHODE FOR He–Ne LASER. Perng, C. C.; Hsu, Y. C.; Lin, S. Y.; Chou, M. C.; Tusi, P. C.; Hsu, Y. C. (National Taiwan Univ., Taipei). Chin. J. Phys. (Taiwan); 13: No. 1, 127-129(Apr 1975).

A lifetime of more than 10,000 has been obtained for He–Ne laser tube, by using the Type 2024 Al alloy as the cold cathode and the oxygen bombardment method for the cathode surface processing. Details of the surface treatment of the cold cathode and the characteristics of the performance in the laser tube are given. (auth)

9118 LASERS AND THEIR USE. Moscow; Izdatel'stvo Nauka (1974). 231p. (In Russian)

Research conducted in the years 1967 to 1972 is cited with respect to several actual problems in quantum radiophysics, especially investigations on induced light scattering, generation and amplification of radiation on the basis of processes of induced scattering and chemical reactions, high-temperature plasma obtained with the aid of laser radiation, and dynamics of strong-current radiating discharges. (Ref. Zh.)

9119 LASER TRANSMITTER SYSTEM. Dye, R. A. (to Hughes Aircraft Co.). US Patent 3,909,745. 30 Sep 1975. Filed date 17 Oct 1974. 6p.

A laser transmitter system is disclosed which utilizes mechanical energy for generating an output pulse. The laser system includes a current developing device such as a piezoelectric crystal which charges a storage device such as a capacitor in response to a mechanical input signal. The capacitor is coupled to a switching device, such as a silicon controlled rectifier (SCR). The switching device is coupled to a laser transmitter such as a GaAs laser diode, which provides an output signal in response to the capacitor being discharged. (auth)

9120 UNSTABLE RESONATOR SYSTEM PRODUCING A HIGH IRRADIANCE BEAM IN THE FAR FIELD. Wisner, G. R.; Mapes, S. N.; Skolnick, M. L. (to United Technologies Corp.). US Patent 3,909,744. 30 Sep 1975. Filed date 24 Sep 1973. 8p.

Laser systems comprising an unstable resonator and optics for increasing the magnification of the output beam from the resonator to concentrate the power distribution in the far field are disclosed. The resonator device produces a beam of laser energy which is an annulus in cross section and matched optics change the energy distribution in the annulus; both refractory and reflecting optics are disclosed. Also graphs describing the intensity distribution of the annular beam under various conditions in both the near field and far field locations in the optical system are provided. (auth)

9121 EVOLUTION OF GAUSSIAN BEAMS AND PULSE STIMULATED EMISSION FROM LASERS WITH UNSTABLE RESONATORS. Isaev, A.A.; Kazaryan, M.A.; Petrash, G.G.; Rautian, S.G.; Shalagin, A.M. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 6, 607-614 (June 1975).

A recurrence formula is derived for the passage of a Gaussian beam across an unstable resonator and across a periodic optical system. An analysis is made of the position and size of a laser beam constriction in an arbitrary unstable resonator. The nature of the variation of the beam diameter on a mirror with its initial parameters and with the number of passes through the resonator is investigated. The evolution of off-axis Gaussian beams is discussed and a generalization of the Lagrange–Helmholtz theorem is given. The process of formation of the diffraction divergence of the output radiation of a laser is followed in the presence of a noncoherent component representing the residue of the original spontaneous radiation. The results are applied to transient processes in a superluminescent laser with an unstable resonator. (auth)

9122 INVESTIGATION OF THE CHARACTERISTICS OF A TUNABLE HIGH-PRESSURE WAVEGUIDE CO_2 LASER. Bazarov, E.N.; Gerasimov, G.A.; Posudin, Yu.I. (Institute of Radio Engineering and Electronics, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 6, 627-630 (June 1975).

An investigation was made of the principal characteristics of a compact single-mode glass-waveguide CO_2 laser. The frequency of this laser was tunable and it was used in high-resolution spectroscopy of the OsO_4 molecule. The laser frequency was tuned within the range 300 MHz by varying the resonator length with a piezoelectric ceramic element. (auth)

9123 EMISSION OF A SINGLE ELLIPTIC MODE FROM A GAS LASER. Vdovin, Yu.A.; Ermachenko, V.M. (Moscow Engineering-Physics Institute). Sov. J. Quantum Electron. 5: No. 6, 642-644 (June 1975).

Equations describing the emission of a single elliptically polarized mode from a gas laser are derived and investigated. The elliptic polarization is frequently observed experimentally when a tube with an active medium is placed inside a Fabry–Perot resonator between two phase plates with nearly quarter-wave properties. The condition for the existence of an elliptically polarized mode is derived for a resonator containing an active medium. (auth)

9124 NATURAL FLUCTUATIONS IN LASERS WITH DISTRIBUTED PARAMETERS. Slin'ko, E.F. (M. V. Lomonosov State University, Moscow). Sov. J. Quantum Electron. 5: No. 6, 668-671 (June 1975).

A one-dimensional model of a ring solid-state laser is used in an analysis of fluctuations, with special attention to fluctuations of the polarization. Expressions are obtained for the spectra of fluctuations of frequencies of the order of the intermode spacing. It is shown that the spectrum of the signal emitted by such a laser consists of two series of spectral lines whose parameters can be determined from expressions for amplitude and phase fluctuations. The stability of single-mode emission is investigated. (auth)

9125 MODULATION OF He–Ne LASER RADIATION BY DISCHARGE CURRENT PERTURBATIONS. Tuchin, V.V.; Akchurin, G.G. (N. G. Chernyshevskii State University, Saratov). Sov. J. Quantum Electron. 5: No. 6, 678-684 (June 1975).

Theoretical and experimental investigations were made of the influence of small harmonic perturbations of the electron density (discharge current) on the output radiation of a He–Ne laser ($\lambda = 0.63$ μ). The frequency response of the output intensity fluctuations to perturbations in the gas-discharge plasma depended strongly on the nature of the saturation of the constant component of the output intensity with increasing discharge current. The inertia of the process of establishment of the electron density in the discharge had a considerable influence on the nature of the frequency response of the intensity fluctuations to perturbations in the discharge current. Modulation of characteristics should make it possible to analyze more fully the mechanism of saturation of the output intensity and to determine the metastable-state lifetimes of helium and neon atoms. (auth)

9126 DYNAMICS OF DEVELOPMENT AND SPECTRAL COMPOSITION OF RADIATION EMITTED BY PLASMA JETS GENERATED AS A RESULT OF INTERACTION BETWEEN A $\lambda = 10.6$ μ LASER BEAM AND VARIOUS MATERIALS. Bakeev, A.A.; Vasil'ev, L.A.; Nikolashina, L.I.; Prokopenko, N.V.; Churilov, A.S.; Yakovlev, V.I. Sov. J. Quantum Electron. 5: No. 6, 693-695 (June 1975).

An experimental investigation was made of the interaction of $\lambda = 10.6$ μ laser pulses with graphite and Duralumin. The power density of the laser pulses was 1–5 MW/cm^2 and the air pressure during irradiation was 0.5–760 mm Hg. The duration of the laser pulses was ~3.3 μsec and the diameter of the irradiated spot was 15 mm. Throughout the investigated range of power densities and air pressures, the emission spectra of plasma jets resulting from the interaction between laser pulses and the investigated targets were quite similar to the spectrum of laser sparks in air. The brightness temperature of the plasma jets was independent (to within the limits of experimental error)

of the target material and was governed by the laser density. The measured values of the velocity of propagation of the luminous jet front at atmospheric pressure were in satisfactory agreement with those calculated from the theory of optical detonation but the rise of the front velocity with decreasing pressure was slower than predicted by this theory. (auth)

9127 CHARACTERISTICS OF IODINE LASER SHORT-PULSE AMPLIFIER. Borovich, B.L.; Zuev, V.S.; Katulin, V.A.; Nosach, V.Yu.; Nosach, O.Yu.; Startsev, A.V.; Stoilov, Yu.Yu. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 6, 695-703 (June 1975).

An investigation was made of the energy balance of a free-oscillation iodine amplifier pumped with light generated by a high-current discharge in the active gas. Some of the pump energy was absorbed in a shock wave traveling ahead of an expanding discharge plasma. Optical inhomogeneities in the amplifying layer were investigated. A transverse gradient of the refractive index in this layer could reach 10^6 cm^{-1}. The magnetic field of the discharge influences strongly the laser emission spectrum, shifting it by 0.2 cm^{-1} during a pulse and broadening it to 0.3 cm^{-1}. When the discharge current passed through zero, the stimulated emission was due to the unperturbed $F=3\rightarrow F=4$ transition in the hyperfine structure of the iodine atom. Thus, a short pulse could be amplified at the moment the current passed through zero. (auth)

9128 LOW-DIVERGENCE PULSE YAG LASER AND ITS TECHNOLOGICAL APPLICATIONS. Braslavskii, E. T.; Lyashenko, A.I.; Rumyantsev, M.I.; Khitro, E.L. Sov. J. Quantum Electron. 5: No. 6, 703-706 (June 1975).

A free-oscillation YAG:Nd laser, emitting pulses at a repetition frequency of 100 Hz, was investigated. The replacement of a plane-mirror resonator with a planoconvex configuration reduced the divergence to 8.5' at the 90% average power level at the expense of a reduction in efficiency by a factor of 1.25. Quantitative estimates based on a theoretical analysis were compared with the experimental results. The lowest possible divergence that could be achieved was governed by the birefringence of the active element. The principal technological parameters of the use of this laser in the cutting of semiconductor plates were determined. (auth)

9129 HIGH-REPETITION-FREQUENCY OPERATION OF VACUUM ULTRAVIOLET HYDROGEN LASER. Antonov, V.S.; Knyazev, I.N.; Movshev, V.G. (Institute of Spectroscopy, Academy of Sciences of the USSR, Akademgorodok, Moscow Province). Sov. J. Quantum Electron. 5: No. 6, 709-710 (June 1975).

A hydrogen laser emitting in vacuum ultraviolet was operated at a high frequency. A narrow waveguide cell was excited by a parallel-plate storage line with a gas discharger. When the repetition frequency was 45 Hz, the total average output power due to 13 transitions in the 161 nm range was 0.4 mW. (auth)

9130 EXPERIMENTAL INVESTIGATION OF OUTPUT PULSES OF A *Q*-SWITCHED ACTIVE RESONATOR. Gol'din, Y.A.; Zudkov, P.I.; Itskhoki, I.Y.; Shvom, E.M. Sov. J. Quantum Electron. 5: No. 6, 711-713 (June 1975).

An experimental investigation was made of the time and energy characteristics of the output pulses of a YAG:Nd laser, whose Q factor was switched by an electro-optical device. The factors governing the duration of the ouput pulses and limiting the minimum duration were determined. The shortest pulse duration obtained for single-mode emission was 3 nsec. It was found that slow Q switching was the main cause of the saturation of the energy of the output pulses. (auth)

9131 INFLUENCE OF THE RESONATOR GEOMETRY ON THE OUTPUT POWER OF A LASER WITH SEVERAL ACTIVE ELEMENTS. Kushnir, V.R.; Nemkov, A.N.; Shkunov, N.V. Sov. J. Quantum Electron. 5: No. 6, 713-715 (June 1975).

A description is given of a method for selecting the resonator geometry of a solid-state laser with several lenslike active elements in such a way as to maximize the output power. The relationship between this power and the optimization parameter is derived. An investigation is reported of a two-element cw YAG:ND^{3+} laser. The experimental results are shown to be in good agreement with the theoretical predictions. (auth)

9132 INFLUENCE OF THE ACTIVE ELEMENT DIAMETER ON THE OUTPUT POWER OF A CW SOLID-STATE LASER. Groshkova, N.N.; Kuzina, L.M.; Kushnir, V.R.; Shkunov, N.V. Sov. J. Quantum Electron. 5: No. 6, 715-717 (June 1975).

An experimental investigation was made of the distribution of the intensity of the pump radiation and heat evolved in an active element as a function of its diameter. When the dependence of the pump enclosure efficiency on the element radius was linear, the optimal diameter of the active element was directly proportional to the pump power and inversely proportional to the losses in the active element. The results of determination of the optimal radius of the active element were in agreement with calculations. (auth)

9133 POSSIBILITY OF USING METASTABLE HELIUMLIKE IONS IN GENERATION OF ULTRASOFT X—RAY STIMULATED RADIATION. Vekhov, A.A.; Makhov, V.N.; Nikolaev, F.A.; Rozanov, V.B. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 6, 718-720 (June 1975).

An experimental investigation demonstrated that, in principle, it should be possible to establish a population inversion needed in an x-ray laser by accumulation of metastable heliumlike ions (Li II*, Be III*, B IV*, B V*, etc.) in the $2s$ state and rapid transfer of these ions to the $2p$ state. A dense decaying plasma produced by a high-current discharge pulse in lithium vapor was the source of metastable ions. A study was made of the composition, density, and velocity of ions leaving the discharge chamber. X-ray luminescence was due to the $2s2p\ ^1P_1 \rightarrow 1s^2\ ^1S_0$($\lambda =$ 19.9 nm) transition pumped by the $1s2s\ ^1S_0 \rightarrow 1s2p\ ^1P_1$ ($\lambda = 962$ nm) radiation produced by an IFP–5000 xenon pulse-discharge lamp. (auth)

9134 HIGH-POWER MULTIELEMENT LONGITUDINALLY PUMPED SEMICONDUCTOR LASER. Bogdankevich, O.V.; Darznek, S.A.; Zverev, M.M.; Svinenkov, A.I.; Ushakhin, V.A. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 6, 729-729 (June 1975).

A description is given of the construction of a multielement laser pumped longitudinally by an electron beam. The output power was 2.3 MW in the form of 100 nsec pulses. The efficiency was 2.5% and the angular divergence was 10. (auth)

9135 OUTPUT ENERGY OF AlAs–GaAs HETEROLASERS. Kolyshkin, V.I.; Larionov, V.R.; Shelovanova, G.N. (A. F. Ioffe Physicotechnical Institute, Academy of Sciences of the USSR, Leningrad). Sov. Phys.—Semicond. 9: No. 5, 632-633 (May 1975).

Results are given of an investigation of the output energy of low-threshold heterolasers as influenced by the composition of the central layer. (AIP)

9136 AMPLITUDE AND FREQUENCY CHARACTERISTICS OF A RING LASER WITH A NONUNIFORM RESONATOR. Birman, A.Y.; Savushkin, A.F. Opt. Spectrosc. (USSR) 39: No. 1, 77-79 (July 1975).

The asymptotic of the frequency characteristics of a ring laser with a nonuniform resonator is constructed, and relations are obtained for the matching band, the constant components, and the depth of modulation of the intensities of the oppositely traveling waves. (auth)

9137 DIFFRACTION INSTABILITY OF THE TWO-WAVE MODE OF OPERATION IN A RING LASER. Birman, A.Ya.; Savushkin, A.F. Opt. Spectrosc. (USSR) 39: No. 1, 117-118 (July 1975).

The scalar formulation of instability theory is applied to the strong-competition region of the two-wave operation in a ring laser.(AIP)

9138 KINETIC PROCESSES IN A LASER-HEATED HELIUM-NITROGEN PLASMA FOR USE AS A UV LASER MEDIUM. Brown, R.T. (United Technologies Research Center, East Hartford, Connecticut 06108). J. Appl. Phys. 46: No. 11, 4767-4773 (Nov 1975).

Experimental and theoretical studies of an optically pumped electric discharge laser in helium-nitrogen mixtures are described. While the inherent efficiency of this system is rather low, these studies illustrate the basic parameters controlling the dynamics and efficiency of such a laser. In the experiments, intense diffuse discharges were obtained at pressures up to 12 atm and amplified spontaneous emission along the axis of the discharge was observed. The numerical modeling studies showed qualitative agreement with the experimental data and gave an optimized value of the kinetic coupling efficiency (absorbed 10.6-μ power to uv laser power) of 1.6% and of the total efficiency (energy stored in the TEA laser supply to uv output energy) of 0.1–0.2%. (auth)

9139 AMPLIFIED SPONTANEOUS EMISSION OF A MOLECULAR NITROGEN LASER EXCITED BY AN INTENSE RELATIVISTIC ELECTRON BEAM. Luches, A.; Perrone, M.R. (Istituto di Fisica dell'Università, Lecce, Italy). J. Appl. Phys. 46: No. 11, 4829-4832 (Nov 1975).

Report of a study of the shape and length of the output pulse of a molecular nitrogen laser, excited by an intense relativistic electron beam, is described. The rate equations are computer solved, at first ignoring the spontaneous emission during the excitation process. Afterwards the rate equations are solved taking into account excitation functions of various shapes and lengths, related to electron-beam pulses of a few kA and a few nsec. Laser power output, energy, and peak-time, i.e., the time at which the gain reaches its saturated value, are given and discussed as functions of the intensity and rise time of the excitation functions. (auth)

9140 HETEROJUNCTION LASER OPERATION OF $GaAs_{1-x}P_x$: N ON NN-PAIR (E_{NN}) AND A-LINE (E_N) TRANSITIONS

NEAR THE DIRECT (Γ) BAND EDGE. Coleman, J.J.; Holonyak, N. Jr.; Ludowise, M.J.; Nelson, R.J.; Wright, P.D. (Department of Electrical Engineering and Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801); Groves, W.O.; Keune, D.L.; Craford, M.G. J. Appl. Phys. 46: No. 11, 4835-4841 (Nov 1975).

Single heterojunction diodes constructed by the LPE growth of $In_{1-y}Ga_yP_{1-z}As_z$ on otherwise identical N-free and N-doped VPE $GaAs_{1-x}P_x$ substrates permit the examination of laser operation on NN-pair (E_{NN}) and *A*-line (E_N) recombination transitions near the direct (Γ) band edge of $GaAs_{1-x}P_x$. Data are presented on the effect of NN-pair states on laser operation in the region $|E_\Gamma - E_{NN}| \lesssim 50$ meV ($E_{NN} < E_\Gamma$, $x \simeq 0.32$), where NN-pair states are degenerate with a large donor band tail ($n_d \simeq 1.6\times10^{18}/cm^3$). The NN-pair states cause increased laser threshold current density, *increased* laser photon energy, and a large effective index $[n-\lambda\,(dn/d\lambda)] \gtrsim 5$ that is free of structure. Photoexcitation data on thin *p*-type platelets prepared from the same substrate crystal are described confirming this behavior. Data are presented also for the case of single N atom (*A*-line) states lying below E_Γ and degenerate with donor tail states in $GaAs_{1-x}P_x:N$ ($x \simeq 0.40$). The laser threshold current is increased because of the N doping, as for NN-pair states, but recombination on the *A* line occurs at lower energy ($E_N < E_\Gamma$) than for otherwise identical N-free diodes, which automatically operate as lasers at high thresholds and photon energies $h\nu \sim E_\Gamma$. In addition, the presence of N-trap states in the region of donor tail states results in the observation of structure (4.2 °K) in the index dispersion $[n-\lambda\,(dn/d\lambda)]$ in the spectral region of the *A* line. This behavior is attributed to the resonant-antiresonant properties of a narrow autoionizing trap state (N trap) located in the donor tail state "continuum". (auth)

9141 XENON-DIMER-LASER NET-GAIN MEASUREMENTS. Johnson, A.W.; Gerardo, J.B. (Sandia Laboratories, Albuquerque, New Mexico 87115). J. Appl. Phys. 46: No. 11, 4870-4874 (Nov 1975).

The gain of the vacuum-ultraviolet xenon-dimer laser was evaluated by employing a double-pass technique with spectral filtering of the probe radiation. At the wavelength center of the continuum-emission spectrum ($\lambda_0 \simeq 1720$ Å), the net-gain coefficient at pressures less than 1.1×10^4 Torr was found to be $g_0 = (1.05\pm0.2)\times10^{-25}P_i\ cm^{-1}$, where P_i is the spontaneous-emisssion intensity of the continuum-emission band in units of photons/sec cm³. By comparison of laser-output waveforms with temporally resolved net-gain measurements, it is shown that the laser intensity is limited by an unidentified time-dependent loss mechanism that is either foreign to the excited medium or that is driven by the laser radiation. While we do not know the source of this mechanism, our observations show that this time-dependent loss mechanism is not associated with the lasing states of the xenon dimer. At very high pressures ($>1.3\times10^4$ Torr) the effects of photoscattering by the background xenon were found to reduce the value of g_0. (auth)

9142 DOUBLE MODE LOCKING OF DYE LASERS. Yasa, Z.A. (Electronics Research Laboratory, University of California, Berkeley, California 94720). J. Appl. Phys. 46: No. 11, 4895-4898 (Nov 1975).

The concept of double mode locking of dye lasers is introduced. A pair of laser dyes with the absorption spectrum of one coinciding with the fluorescence spectrum of the other is shown to become mode locked about two different wavelengths simultaneously. Numerical calculations predict rapid development of subpicosecond pulses. (auth)

9143 WATER SPARK GAP FOR A NITROGEN LASER. Saikan, S.; Shimizu, F. (Department of Applied Physics, Faculty of Engineering, University of Tokyo, Bunkyo-ku, Tokyo 113, Japan). Rev. Sci. Instrum. 46: No. 12, 1700-1701 (Dec 1975).

Satisfactory operation of the Blumlein type nitrogen laser was obtained by using a water-filled spark gap. The water-filled spark gap uses flowing water, and the Blumlein circuit is charged by a Marx-bank driver. (auth)

9144 CONTROLLED PASSIVE *Q* SWITCH FOR THE N_2-LASER PUMPED DYE LASER. Braverman, L. W. (Electronics Research Laboratory, University of California, Berkeley, California 94720). Appl. Phys. Lett. 27: No. 11, 602-604 (1 Dec 1975).

A method for obtaining a single *Q*-switched laser pulse from dye lasers is presented. The method employs a passive *Q* switch triggered after time delay by a control beam. The delay time is adjusted until single high-power pulses are produced. Peak power in the dye laser is shown to increase by a factor of 6 due to the *Q* switch. The results are compared to solid-state laser theory. (auth)

9145 EXCITED STATE ABSORPTION AND LASER EMISSION FROM INFRARED LASER DYES OPTICALLY PUMPED AT 532 NM. Decker, C.D. (GTE Sylvania, Incorporated, Electro-Optics Organization, P. O. Box 188, Mountain View, California 94042). Appl. Phys. Lett. 27: No. 11, 607-609 (1 Dec 1975).

Efficient near-infrared dye laser emission has been achieved in the 838–923-nm range by use of a frequency-doubled Nd:YAG laser as the optical pump for various polymethine dyes. Experimental evidence of 1064-nm quenching of the dye laser emission is reported. Strong excited state absorption (ESA) effects are observed for the dye IR-140 at the 532-nm pump wavelength. This excited state absorption results in an experimentally determined optimum pump power density of 50–60 MW/cm² for maximum dye laser efficiency. Such excited state absorption may thus be a limiting factor in the power scaling of pulsed dye lasers. (auth)

9146 A SECOND LOOK AT THE EXCITATION MECHANISM OF THE He-Hg^+ LASER. Kano, H.; Shay, T.; Collins, G.J. (Department of Electrical Engineering, Colorado State University, Fort Collins, Colorado 80523). Appl. Phys. Lett. 27: No. 11, 610-612 (1 Dec 1975).

We have resolved the controversy in the literature concerning the dominant excitation mechanism of the cw mercury ion laser by obtaining the first *direct* experimental proof that thermal energy charge transfer is the dominant formation process for the excited $7p^2P$ terms of Hg II which support cw laser oscillation of 6150 and 7944 Å. Using a floating double probe we have monitored *directly* the helium ion density versus time and confirmed its one-to-one correspondence with the measured decay of spontaneous emission from the Hg II $7p^2P$ levels. The measured value of the cross section, σ (He^+-Hg), is $1.3\times10^{-14}cm^2$ and confirms earlier work by Dyson. (auth)

9147 AMPLIFICATION OF MULTILINE/MULTIBAND CO_2 LASER PULSES. Figueira, J.F.; Ladish, J.S.; Schappert, G.T.; Thomas, S.J. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). Appl. Phys. Lett. 27: No. 11, 591-592 (1 Dec 1975).

Amplification measurements of single-line and multiline/multiband nanosecond CO_2 laser pulses are reported. It is shown that at amplifier pressures of 600 Torr the saturation energy for multiline pulses is twice as large as for single-line pulses. (auth)

9148 CW LASER OSCILLATION IN Cu II. McNeil, J.R.; Collins, G.J. (Department of Electrical Engineering, Colorado State University, Fort Collins, Colorado 80523); Persson, K.B.; Franzen, D.L. Appl. Phys. Lett. 27: No. 11, 595-598 (1 Dec 1975).

We have obtained cw laser oscillation on 23 transitions of Cu II in the blue-green and near infrared by exciting either a He-Ar, He-Ne, or a He-Xe discharge in a *copper* hollow cathode. The Cu II wavelengths range from 4506 to 7988 Å. Output characteristics of the Cu II laser lines as functions of helium pressure; He:Ar, He:Ne, and He:Xe mixture ratios; and discharge current are presented. Single-line output power, from the 7808-Å transition of Cu II of 150 mW has been obtained. (auth)

9149 TIME VARIATION OF ELECTRON DENSITY IN A PULSED He-Kr^+ ION LASER. Kato, I.; Satake, T.; Nakaya, M.; Shimizu, T. (School of Science and Engineering, Waseda University, Shinjuku-ku, Tokyo 160, Japan). J. Appl. Phys. 46: No. 11, 5051-5052 (Nov 1975).

The time variation of the electron density has been measured in the early afterglow of microwave-pulse excited He, Kr, and He-Kr gas discharges. It is observed that the decay of the electron density is mainly caused by volume recombination of electrons and ions, and that an ionization by He metastable atoms occurs in the afterglow plasma, and that about 2 μsec after, the decay of electron density decreases. (auth)

9150 TWO-PHOTON FLUORESCENCE IN ATTENUATING MEDIA AND LASER PULSE DURATION MEASUREMENTS. Bechtel, J.H.; Smith, W.L. (Gordon McKay Laboratory, Harvard University, Cambridge, Massachusetts 02138). J. Appl. Phys. 46: No. 11, 5055-5056 (Nov 1975).

Analytical and numerical results are obtained for two-photon fluorescence in an attenuating medium. Cases of one- and/or two-photon attenuation are considered. These results are interpreted with respect to the measurement of ultrashort laser pulses. (auth)

9151 GAIN SATURATION IN DISTRIBUTED FEEDBACK LASERS. Haus, H.A. (Bell Laboratories, Holmdel, New Jersey 07733). Appl. Opt. 14: No. 11, 2650-2652 (Nov 1975).

An approximate method is presented for the analysis of overcoupled distributed feedback lasers. A closed form expression is obtained for the power emitted by a laser normalized to the saturation power in terms of the loss coefficient α_L, small signal gain coefficient α_0, coupling parameter κ, and length of the laser *L*. The result is compared with published computer solutions, and good agreement is obtained in the range $|\kappa|L > 4$; qualitative agreement extends to $|\kappa|L = 1$. The closed form expression is adapted to predict the saturation behavior of leaky-wave lasers. (auth)

9152 LASER EMISSION CROSS SECTION OF THE SYSTEM $LiNd_{0.5}M_{0.5}P_4O_{12}$ (*M*=Gd, La). Otsuka, K.; Nakano, J.; Yamada, T. (Musashino Electrical Communication Laboratory, Nippon Telegraph and Telephone Public Corporation, Musashino-shi, Tokyo, Japan). J. Appl. Phys. 46: No. 12, 5297-5299 (Dec 1975).

The laser-related spectroscopic parameters such as the laser transition cross section and fluorescence lifetime of the compositions $LiNd_{0.5}Gd_{0.5}P_4O_{12}$ and $LiNd_{0.5}La_{0.5}P_4O_{12}$ were examined. The products of the measured emission cross section and fluorescence lifetime of the $^4F_{3/2}$ manifold in the mixed crystals were estimated to be very close to the product in the pure $LiNdP_4O_{12}$ crystal. The laser emission was linearly polarized along the pseudoorthorhombic c axis of the crystal in these mixed crystals, as was done for LNP. (auth)

9153 ROOM-TEMPERATURE OPERATION AND THRESHOLD TEMPERATURE DEPENDENCE OF LPE-GROWN $In_xGa_{1-x}As$ HOMOJUNCTION LASERS. Nahory, R.E.; Pollack, M.A.; Taylor, D.W.; Fork, R.L. (Bell Telephone Laboratories, Holmdel, New Jersey 07733); Dixon, R.W. J. Appl. Phys. 46: No. 12, 5280-5282 (Dec 1975).

$In_xGa_{1-x}As$ homojunction lasers prepared by liquid-phase epitaxy have been operated from below 77 °K to room temperature. Lowest thresholds were $J_{th}=2000$ A/cm² at 77 °K and 290 000 A/cm² at room temperature. The variation of threshold with temperature can be fit by either $J_{th}\sim T^3$ or $J_{th}\sim\exp(T/67\,°K)$ above ~150 °K, and by $J_{th}\sim T^{2.3}$ at lower temperatures. (auth)

9154 THREE-MIRROR DOUBLE-PASS LASER. Oettinger, P.E. (Thermo Electron Corporation, Waltham, Massachusetts 02154). J. Appl. Phys. 46: No. 12, 5288-5289 (Dec 1975).

A new laser configuration is conceived and tested, wherein intracavity quarter-wave plate and beam splitting polarizer produce laser oscillations between three mirrors. The main advantages of this configuration are to offer choice of polarization output from a single cavity and to increase the efficiency of specific lasers. (auth)

9155 HIGH-ENERGY PULSED CO CHEMICAL LASER. Tiee, J.J.; Quick, C.R. Jr.; Harper, C.D.; Petersen, A.B.; Wittig, C. (Electrical Engineering Department, University of Southern California, University Park, Los Angeles, California 90007). J. Appl. Phys. 46: No. 12, 5191-5193 (Dec 1975).

A high-energy pulsed CO chemical laser has been constructed. Vibrationally excited CO molecules are produced via the reaction $O+CS\rightarrow CO^*+S$. A laser output of 240 mJ/pulse is obtained when a mixture of CS_2 and O_2 is flash photolyzed without any additives. When small amounts of N_2O and O_3 are introduced, an output energy of 360 mJ/pulse is obtained. (auth)

9156 THRESHOLD CHARACTERISTICS OF MULTIMODE LASER OSCILLATORS. Casperson, L.W. (School of Engineering and Applied Science, University of California, Los Angeles, California 90024). J. Appl. Phys. 46: No. 12, 5194-5201 (Dec 1975).

The oscillation characteristics of a multimode laser are considered in detail, and for the first time saturation by all of the cavity modes is included. Analytical expressions are obtained for the mode amplitudes, linewidths, and over-all spectral characteristics of lasers operating above and below threshold. It is found that with increasing excitation the spontaneous emission spectrum is gradually resolved into a set of narrow discrete modes. Slightly above threshold the number of modes reduces in a homogeneously broadened laser until only a single mode is oscillating strongly. The theoretical results are in agreement with experimental data that have been reported using semiconductor lasers. With inhomogeneous broadening the spectral width goes through a minimum near threshold. (auth)

9157 HO LASER WITH 50-W OUTPUT AND 6.5% SLOPE EFFICIENCY. Beck, R.; Gürs, K. (Battelle Institut, e.V., Frankfurt/Main, West Germany). J. Appl. Phys. 46: No. 12, 5224-5225 (Dec 1975).

We report the observation of continuous high-power laser emission from sensitized YAG. The crystal was immersed in flowing liquid oxygen precooled to 77 K. With a linear tungsten-halogen lamp in a single-ellipse pumping configuration an output power of 50 W with a 6.5% slope efficiency was obtained. (auth)

9158 FREQUENCY STABILIZATION AND ABSOLUTE FREQUENCY MEASUREMENTS OF A cw HF/DF LASER. Eng, R.S.; Spears, D.L. (Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, Massachusetts 02173). Appl. Phys. Lett. 27: No. 12, 650-652 (15 Dec 1975).

A transverse-flow mixing HF/DF laser transition was frequency stabilized to better than 500 kHz relative to the second harmonic of a CO laser using a heterodyne technique. An absolute frequency of 110 725 697.4±7 MHz was measured for the 1-O*P* (6) line of the HF laser, which represents a factor of 100 improvement in accuracy over existing data. (auth)

9159 VERY LOW-THRESHOLD DOUBLE-HETEROJUNCTION $Al_xGa_{1-x}As$ INJECTION LASERS. Ettenberg, M. (RCA Laboratories, Princeton, New Jersey 08540). Appl. Phys. Lett. 27: No. 12, 652-654 (15 Dec 1975).

Double-heterojunction $Al_xGa_{1-x}As$ lasers have been prepared with a compositional discontinuity Δx at the heterojunctions of 0.45–0.68 and active region widths of ~0.1 μm. These devices have the lowest room-temperature threshold current densities (475 A/cm²) yet reported, with a differential quantum efficiency of 40% or more. (auth)

9160 VIBRATION-VIBRATION PUMPING OF CARBON MONOXIDE INITIATED BY AN OPTICAL SOURCE. Rich, J.W.; Bergman, R.C.; Raymonda, J.W. (Calspan Corporation, Buffalo, New York 14221). Appl. Phys. Lett. 27: No. 12, 656-658 (15 Dec 1975).

A steady-state nonequilibrium population distribution of the vibrational states of carbon monoxide has been produced by optical pumping. A supersonic flow CO laser was used to excite a flowing mixture of CO which is pressure broadened by argon. A V-V pumped nonequilibrium distribution was measured over the first 30 vibrational states of CO. (auth)

9161 IMPROVED CW LASER ACTION ON THE 118.6- AND 220-μm H_2O TRANSITIONS USING HELIUM AND HYDROGEN. Woskoboinikow, P.; Jennings, W.C. (Electrical and Systems Engineering Department, Rensselaer Polytechnic Institute, Troy, New York 12181). Appl. Phys. Lett. 27: No. 12, 658-660 (15 Dec 1975).

The power of a cw water-vapor laser operating on the far-infrared transitions of 118.6 and 220 μm has been considerably improved by the use of helium and hydrogen gas additives. The laser power on the 118.6-μm transition has been increased by an order of magnitude from 1.5 to 15 mW in a nonoptimized cavity. For the same discharge current of 1.8 A, the power on the 220-μm line has been increased from 0.26 to 1.3 mW. (auth)

9162 MODE LOCKING OF A He-Ne 3.39-μm LASER USING STRONG INTERNAL PHASE MODULATION. Konishi, S.; Kobayashi, T.; Sueta, T. (Department of Electrical Engineering, Faculty of Engineering Science, Osaka University, Toyonaka, Osaka, Japan). Appl. Phys. Lett. 27: No. 12, 660-662 (15 Dec 1975).

The possibility of generating ultrashort optical pulses from narrow-linewidth lasers by means of mode locking is discussed. An experiment using a He-Ne 3.39-μm laser and applying strong intracavity phase (FM) modulation of 580 MHz was performed to demonstrate the possibility. The oscillation bandwidth was observed to be increased over a frequency range of 7 GHz. The pulsewidth estimated from the power spectrum was about 170 ps, while the reciprocal of the linewidth was about 3 ns. (auth)

9163 HIGH-PRESSURE ABSORPTION SPECTRUM OF CO_2 LASER BANDS AT 10 μM. Miller, J.L.; George, E.V. (Department of Electrical Engineering and Computer Science, and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Appl. Phys. Lett. 27: No. 12, 665-667 (15 Dec 1975).

The absorption coefficient at the center of several lines of the 961- and 1064-cm^{-1} bands of CO_2 has been measured for CO_2 and mixtures of CO_2 and N_2 and He at absolute pressures to 18 atm. The data are in good agreement with the theory of pressure-broadened non-Lorentzian overlapping lines, which predicts greater peak absorption than theories that calculate the spectrum as a sum of Lorentzian-shaped lines. (auth)

9164 PUMP ABSORPTION AND SATURATION IN THE CH_3F 496-μm LASER. Hodges, D.T.; Tucker, J.R. (Electronics Research Laborntory, The Aerospace Corporation, P. O. Box 92957, Los Angeles, California 90009). Appl. Phys. Lett. 27: No. 12, 667-669 (15 Dec 1975).

Results are presented from a series of diagnostic experiments designed to measure the fundamental absorption parameters in CH_3F for the *P* (20) CO_2 laser line at 9.55 μm. These parameters include the small-signal absorption coefficient, the saturation intensity for the absorbing transition, and the homogeneous linewidth. These data provide a quantitative characterization of the pumping process for the cw CH_3F laser operating at 496 μm. (auth)

9165 D_2-CO_2 AND D_2-N_2 ELECTRIC DISCHARGE GAS-DYNAMIC LASERS. Stregack, J.A.; Wexler, B.L.; Hart, G.A. (Laser Physics Branch, Naval Research Laboratory, Washington, D.C. 20375). Appl. Phys. Lett. 27: No. 12, 670-671 (15 Dec 1975).

cw CO_2 and N_2O lasing has been obtained in a new electric discharge gas-dynamic laser device. The device consists of a subsonic plenum discharge region where vibrational excitation occurs, a supersonic nozzle array where the laser species is injected, and a supersonic cavity where mixing, energy transfer, and lasing occur. In the present experiments both CO_2 and N_2O are pumped by energy transfer from D_2 excited in the discharge. Comparisons are made for CO_2 pumped by both N_2 and D_2, and N_2O and CO_2 pumped by D_2. (auth)

9166 OUTPUT FLUX INSTABILITIES IN A FLOWING-GAS cw CO_2 ELECTRIC DISCHARGE LASER. Yoder, M.J.; Ahouse, D.R. (Avco-Everett Research Laboratory, Everett, Massachusetts 02149). Appl. Phys. Lett. 27: No. 12, 673-676 (15 Dec 1975).

Temporal measurements of laser output flux of a flowing-gas cw CO_2 electron-beam-sustainer electric discharge laser exhibit large fluctuations. The amplitude of the fluctuations varies from 20 to 100% depending on cavity pressure, unstable resonator output coupling, and discharge specific power loading. Sharp discontinuities are observed in the laser medium when output flux is extracted. Gain measurements made

simultaneously with output flux extraction show large fluctuations both above and below cavity threshold. These results are consistent with a basic self-oscillation instability mechanism proposed for fast-flow cw lasers using unstable resonators. (auth)

9167 HIGH-PRESSURE INFRARED Ar-Xe LASER SYSTEM: IONIZER-SUSTAINER MODE OF EXCITATION. Newman, L.A.; DeTemple, T.A. (Electro-Physics Laboratory, Department of Electrical Engineering, University of Illinois, Urbana, Illinois 61801). Appl. Phys. Lett. 27: No. 12, 678-680 (15 Dec 1975).

Laser action on neutral Xe transitions has been achieved at 1-atm pressure in Ar-Xe and He-Xe mixtures excited in an ionizer-sustainer mode of discharge. A number of near-infrared lines oscillated in both mixtures with the strongest at 1.73 μm in Ar-Xe. Over-all conversion efficiencies of 0.2% in He-Xe and 1% in Ar-Xe were obtained with resulting output powers of 100–200 kW. These represent an order-of-magnitude increase in power, energy per pulse, and efficiency over previously reported observations on conventional transverse discharge lasers. (auth)

9168 $LiNdP_4O_{12}$ LASER PUMPED WITH AN $Al_xGa_{1-x}As$ ELECTROLUMINESCENT DIODE. Saruwatari, M.; Kimura, T.; Yamada, T.; Nakano, J. (Musashino Electrical Communication Laboratory, Nippon Telegraph and Telephone Public Corporation, Musashino-shi, Tokyo 180, Japan). Appl. Phys. Lett. 27: No. 12, 682-684 (15 Dec 1975).

Using an incoherent $Al_xGa_{1-x}As$ light-emitting diode (LED) as a pump source, pulsed laser oscillation was observed in a 300-μm-thick $LiNdP_4O_{12}$ crystal cooled to −35 °C. The oscillation threshold power density is 8.2 W/cm² for the LED pump, and is compared with that for an Ar laser pump and theoretical values. The temperature dependence of oscillation threshold and optical round-trip loss are discussed. (auth)

9169 TUNABLE DISTRIBUTED-FEEDBACK DYE LASER. Aoyagi, Y.; Aoyagi, T.; Toyoda, K.; Namba, S. (The Institute of Physical and Chemical Research, Wako-shi, Saitama, 351 Japan). Appl. Phys. Lett. 27: No. 12, 687-688 (15 Dec 1975).

A tuning range of more than 160 Å was obtained in a rhodamine 6G distributed-feedback laser by using a mechanical tuning method. An electromechanical tuning of about 10 Å was also obtained. (auth)

9170 THEORETICAL INVESTIGATION OF THE KINETICS OF CHEMICAL LASERS. Igoshin, V. I. Tr. Fiz. Inst., Akad. Nauk SSSR; 76: 117-145(1974). (In Russian).

A number of questions involving the theory of chemical lasers are considered. Mathematical models are developed for the processes in mixtures of $H_2 + F_2$, $D_2 + F_2 + CO_2$. A detailed study is made of the influence of various factors on inverse population. (auth)

9171 STUDY OF PLASMA PARAMETERS IN He–Se GAS DISCHARGE. Christov, N. N.; Pramatarov, P. M.; Sabotinov, N. V. (Inst. of Solid State Physics, Sofia). Bulg. J. Phys.; 2: No. 2, 153-156(1975).

The electron temperature and the axial electric field strength are measured in a laser-like He–Se discharge by the double-probe method. The electron concentration is calculated from the discharge current density equation. (auth)

9172 HIGH POWER DOUBLE DISCHARGE TEA CO_2 LASER. Yamabe, C.; Setoyama, E.; Yokoyama, M.; Yamanaka, C. (Osaka Univ.). Technol. Rep. Osaka Univ.; 24: 495-520(Oct 1974).

The characteristics of a high-power double-discharge TEA CO_2 laser are described. The laser output energy is more than 30 J and the laser peak power is more than 0.3 GW. The gain coefficient measured at the center of the discharge is 4 to 4.5% per cm. The effect of adding xylene on the uniformity of the discharge and the laser peak power is also reported. In addition, the reflectivity of the laser light coming from the produced plasma was measured. (auth)

9173 LASER-INITIATED KRYPTON-SWITCHED BLUMLEIN STRUCTURE FOR PULSE SELECTION. Hyer, R. C.; Sutphin, H. D.; Winn, K. R. (Los Alamos Scientific Lab., NM). Rev. Sci. Instrum.; 46: No. 10, 1333-1334(Oct 1975).

A method is described for the selection of a mode-locked pulse from a laser by the use of a laser-initiated krytron-switched Blumlein structure that replaces the usual high voltage spark gap. The main features are an all electronic circuit coupled to a longitudinal mode KD*P Pockels cell that has a fast risetime and high extinction ratio. The result is an inexpensive, noise-free pulse selector that provides a stable source of switched out pulses. (auth)

9174 COAXIAL SHORT PULSED LASER. Nelson, M. A.; Davies, T. J. (to U. S. Energy Research and Development Administration). US Patent 3,898,586. H01s3/22; H01s3/09. 5 Aug 1975. Filed date 8 Jan 1974. 8p. PAT-APPL-431,817.

This invention relates to a laser system of rugged design suitable for use in a field environment. The laser itself is of coaxial design with a solid potting material filling the space between components. A reservoir is employed to provide a gas lasing medium between an electrode pair, each of which is connected to one of the coaxial conductors. (auth)

9175 THEORY OF MODE LOCKING WITH A SLOW SATURABLE ABSORBER. Haus, H. A. (Bell Telephone Labs., Holmdel, NJ). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 9, 736-746(Sep 1975).

A closed-form solution is presented for the pulses of a homogeneously broadened laser mode locked by a saturable absorber of relaxation time much longer than the pulsewidth. With suitable approximations, the pulse shape is a secant hyperbolic. The system is described in terms of the linewidth of the system, the saturation energies of the saturable absorber and the laser medium, the ratio of saturable-absorber loss to resonator loss, and the ratio of cavity round-trip time and laser-medium relaxation time. The energy and width of the pulse are obtained as functions of these parameters. Graphs are presented for the operating regimes as bounded by the choice of the preceding parameters. The theoretical predictions are compared with second-harmonic-generation autocorrelation traces of mode-locked dye-laser pulses. (auth)

9176 LOW-THRESHOLD, TRANSVERSELY EXCITED NdP_5O_{14} LASER. Chinn, S. R.; Pierce, J. W.; Heckscher, H. (Massachusetts Inst. of Tech., Lexington). IEEE (Inst. Electr. Electron. Eng.). J. Quant. Electron.; QE-11: No. 9, 747-754(Sep 1975).

The room-temperature lasing behavior of NdP_5O_{14} (NdPP) transversely pumped at 0.58-mu m wavelength by a cw dye laser in an excitation geometry simulating that of an LED or laser diode was measured. For a crystal 760 mu m long, the lowest transverse threshold was 4 mW. From this threshold and a theoretical relationship between excitation efficiency and pump wavelength, it is predicted that a threshold of approximately 8.5 mW should be possible for excitation by an edge-emitting 0.8-mu m wavelength LED. Using thin NdPP samples with reflecting back surfaces for better excitation efficiency should lower this threshold by approximately 60 percent, and give minimum optical-to-optical conversion efficiencies of approximately 3.5 percent. (auth)

9177 GAIN CHARACTERISTICS OF A MULTIATMOSPHERE UV-PREIONIZED CO_2 LASER. Alcock, A. J.; Fedosejevs, R.; Walker, A. C. (National Research Council of Canada, Ottawa). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 9, 767-773(Sep 1975).

The small-signal gain of a transverse-discharge UV-preionized CO_2 laser was investigated at pressures in the 1 to 15-atm range. Measurements were carried out on the P(18) and R(16) lines of both the 10.4- and 9.4-mu m bands, and data on the pressure dependence of the peak gain and gain rise time are presented. The results demonstrate that small-signal gains in excess of 5-percent cm^{-1} are readily obtained at pressures of approximately 12 atm and confirm that the relaxation times of the energy levels relevant to laser action scale inversely with pressure. In addition, it is found that the gain of both R branches increases more rapidly with pressure than that of the P branches, while there are indications that the 9.4- and 10.4-mu m gain values become comparable at pressures of approximately 15 atm. The experimental results are compared with the dependence of gain on pressure predicted by a relatively simple theoretical model. On the basis of this model it is found that the experimentally determined gain rises more rapidly with pressure than one would expect and a number of possible reasons for this discrepancy are discussed. (auth)

9178 OPTIMIZATION OF A LASER COMMUNICATIONS SYSTEM USING ELECTROOPTIC MODULATION. Waksberg, A. L. (RCA Research Labs., Ste-Anne de Bellevue, Quebec). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 9, 778-782(Sep 1975).

An analysis is made of the optimum carrier-to-noise ratio (CNR) that can be obtained from a laser communications system using external polarization electrooptic modulation and avalanche diode detection. The analysis is not restricted to low-modulation index but covers the range up to the maximum possible modulation. Alternate definitions of modulation index are given in terms of communication concepts. Finally, some practical uses of the results are discussed. (auth)

9179 INTERFEROMETRIC STUDIES OF MODE-LOCKED Nd^{3+}:GLASS LASERS. Shah, R. R.; Rabson, T. A.; Kim, D. M. (Rice Univ., Houston, TX). IEEE (Inst. Electr. Electron. Eng.). J. Quant. Electron.; QE-11: No. 9, 783-788(Sep 1975).

A general technique for measuring the electric-field vector of the ultrashort pulses from mode-locked laser systems is described. The technique is applied to perhaps the most difficult laser to analyze, the dye mode-locked Nd^{3+}:glass laser whose pulses change

rapidly in bandwidth and amplitude, are chirped, and can occur in quite short pulse trains. The results of these measurements indicate a rather rapid change in the phases between modes, and a plot of the phase change as a function of mode frequency has been obtained. (auth)

9180 EXCITATION OF COLD CAVITY MODES IN A COUPLING-MODULATED CO_2 LASER. Scholtz, A. L. (Technische Hochschule, Vienna). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 9, 791-793(Sep 1975).

The amplitudes of cold longitudinal cavity modes excited as an unwanted side effect of coupling modulation were studied in a CO_2 laser. Experimental observations agree well with the results of an analytical approach treating the effect of coupling modulation on the cavity field as loss modulation. (auth)

9181 NONRADIATIVE RELAXATION OF RARE-EARTH IONS IN SILICATE LASER GLASS. Layne, C. B.; Lowdermilk, W. H.; Weber, M. J. (Univ. of California, Livermore). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 9, 798-800(Sep 1975).

Rates for nonradiative decay by multiphonon emission are measured for rare-earth ions in silicate laser glass and used to estimate quantum efficiencies. (auth)

9182 LONG-PULSE GENERATION IN RHODAMINE-6G PUMPED BY A CO_2-LASER-HEATED PLASMA. Brown, R. T. (United Technologies Research Center, East Hartford, CT). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 9, 800-802(Sep 1975).

Results obtained using a laser-heated plasma as the pumping source for a dye laser are described. A small dye laser using a cylindrical close-coupled pumping arrangement was operated at various xenon pressures. Dye-laser pulses with 20-ns rise times and 800-ns pulsewidths were obtained. (auth)

9183 APODISED APERTURE USING ROTATION OF PLANE OF POLARIZATION. Simmons, W. W.; Leppelmeier, G. W.; Johnson, B. C. (to U. S. Energy Research and Development Administration). US Patent 3,904,273. G02F1/22. 9 Sep 1975. Filed Date 18 Mar 1974. 4p.

PAT-APPL-452,165.

An apodised aperture based on the rotation of plane of polarization producing desirable characteristics on a transmitted light beam such as beam profiling in high flux laser amplifier chains is described. The apodised aperture is made with a lossless element by using one or more polarizers and/or analyzers and magneto-optical Faraday means for selectively rotating the plane of polarized radiation over the cross section to effect the desired apodisation. (auth)

9184 EXPLOSIVE LASER. Robinson, C. P.; Jensen, R. J.; Davis, W. C.; Sullivan, J. A. (to U. S. Energy Research and Development Administration). US Patent 3,904,985. H01S3/22; H01S3/095. 9 Sep 1975. Filed date 5 Feb 1974. 12p.

PAT-APPL-439,793.

This patent relates to a laser system wherein reaction products from the detonation of a condensed explosive expand to form a gaseous medium with low translational temperature but high vibration population. Thermal pumping of the upper laser level and deexcitation of the lower laser level occur during the expansion, resulting in a population inversion. The expansion may be free or through a nozzle as in a gas-dynamic configuration. In one preferred embodiment, the explosive is such that its reaction products are CO_2 and other species that are beneficial or at least benign to CO_2 lasing. (auth)

Cryogenic and Superconducting Equipment and Devices

Refer also to abstracts 8869, 9077, 9872, 9894, and 9962.

9185 (CONF-720133-P10, pp 3-31) LARGE SCALE APPLICATIONS OF SUPERCONDUCTIVITY. Schwartz, B. B. (Massachusetts Inst. of Tech., Cambridge). 1972.

From 4th symposium on theoretical physics; Rio de Janeiro, Brazil (4 Jan 1972).

In IV Brazilian symposium on theoretical physics. Vol. X.

The basic principles of superconductivity required for understanding some applications are reviewed. The main body of the paper concerns large-scale applications of superconductivity to motors and generators, ac power transmission, and magnetic levitation for high-speed ground transportation. (TFD)

9186 (EUR-CEA-FC-768) USE OF THE UPPER RADIAL ORDER MODES IN SPHERICAL SUPERCONDUCTING CAVITIES. Reuss, J. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Apr 1975. 34p. (In French). INIS.

Spherical cavities resonating on a high g radial order mode are considered. The ratio of the maximum magnetic field inside the cavity to the maximum field on the wall is proportional to g. The proportion coefficient is given for the $TE_{(g10)}$; $TE_{(g20)}$, $TM_{(g10)}$, and $TM_{(g20)}$ modes. That corresponds to an energy concentration at the center. Owing to this property the superconducting cavities might be used to produce strong H. F. magnetic fields (larger than 10 Teslas). (FR)

9187 (JUL-1140-SE) CURRENT HEAT LOSS OF HIGH-CURRENT CABLES IN LOADING WITH SYMMETRICAL THREE-PHASE CURRENT AND COOLING WITH LIQUID NITROGEN. Heller, I. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)). Nov. 1974. 56p. (In German). Dep NTIS (US Sales Only) $5.50.

Results of experimental and theoretical investigations in power losses of high current cables when loaded with symmetrical three phase current are given. Measurements on various conductor arrangements were done at room temperature (~300°K) and at liquid nitrogen temperature (~77°K). These studies were performed in order to test simple calculation methods on their applicability when conductor cross section or conductivity are very high and to suggest improvements of the methods if necessary. By cooling with liquid nitrogen (LN_2) it is possible to measure effects already at low conductor cross section which occur at normal temperature only when cross sections are very large. The very simple "cryostat" for the cooling fluid was made from polyurethane-foam blocks and tightened by two layers of polyester-foil. Its length was about 15 meters. (auth)

9188 (ORNL-TM-5187) SURVEY OF RADIATION DAMAGE EFFECTS IN SUPERCONDUCTING MAGNET COMPONENTS AND SYSTEMS. Guess, J. F.; Boom, R. W.; Coltman, R. R. Jr.; Sekula, S. T. (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 42p. Dep. NTIS $5.00.

A study has been made of the published investigations of fast-particle irradiations at low temperatures on the properties of likely CTR magnet materials. The materials topics included in this survey are: (1) irradiation of Nb-Ti alloys with fast neutrons, protons, deuterons, and electrons; (2) irradiation of A-15 compounds (mainly Nb_3Sn) with fast neutrons, deuterons, and oxygen ions; (3) irradiation of Cu and Al with fast and thermal neutrons; (4) irradiation of insulators with neutrons and gamma rays; and (5) irradiation of structural materials with neutrons. The study of the literature also included the available information on the effects of low-temperature irradiation on integrated components of the materials described above which might be envisaged in the construction of a CTR magnet system, since the ultimate problem is the operation of a magnet system in a radiation environment. (TFD)

9189 REFRIGERATION PLANT WITH 300W CAPACITY AT 1.8K. Daus, W. (Hoechst, AG, Frankfurt am Main); Ewald, R. Cryogenics; 15: No. 10, 591-598(Oct 1975).

An industrial-scale helium II refrigeration plant operating at 1.8°K with a low specific energy consumption (436 kW_{el} for 370 W effective refrigeration) was built to cool superconducting components of particle accelerators and separators. The performance, the control system, and the important aggregate components of the plant are described; comparison is made with similar plants built previously. (auth)

9190 APPLICATION OF SUPERCONDUCTING MAGNETS. I. Heinz, W. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Phys. Bl.; 31: No. 5, 197-207(May 1975). (In German)

10 figs.; 1 tab.; 5 refs.

In the review article, possible applications for superconducting magnets in high-field research, as detector magnets for bubble chambers, and as beam guiding magnets, are discussed. Furthermore, pulsed superconducting magnets, shielding magnets and magnets of large field constancy are discussed. (GE)

9191 INVESTIGATION OF TYPE-II SUPERCONDUCTORS WITH NEUTRONS. Weber, H. W. (Atominstitut der Oesterreichischen Hochschulen, Vienna); Hittmair, O. (Technische Hochschule, Vienna (Austria). Inst. fuer Theoretische Physik). Atomkernenergie; 25: No. 4, 234-242(1975).

16 figs.; 62 refs.

The application of neutron physical methods to study the magnetic properties of type-II superconductors is reviewed. In the first part, the progress in the understanding of the mixed state of type-II superconductors as provided to a major part by neutron diffraction experiments in the last decade is discussed and compared with recent developments of theory. In the second part, some aspects of neutron diffraction and polarized neutron transmission experiments concerning the mechanisms of flux pinning are reported. (auth)

9192 JOSEPHSON JUNCTIONS. Fritsch, G. Phys. Unserer Zeit; 6: No. 4, 126-127(Jul 1975). (In German)

4 figs.; 3 refs.

This survey gives some applications for Josephson elements: as measuring instrument with extremely low spectral sensitivity, as nonlinear element in frequency mixing, and as wide-band receptors. (GE)

9193 PULSE PROPAGATION ON A SUPERCONDUCTIVE NEURISTOR. Reible, S.A.; Scott, A.C. (The University of Wisconsin, Madison, Wisconsin 53706). J. Appl. Phys. 46: No. 11, 4935-4945 (Nov 1975).

Both analytic study and experimental investigations on an electronic analog are presented which indicate the unstable nature of Parmentier's traveling-wave pulse on a superconductive neuristor. In the vicinity of a critical bias level, the pulse is almost stable in the sense that pulse distortion over a finite distance can be made arbitrarily small by adjusting the bias to be sufficiently close to the critical value. It is also shown that the strength-duration curve for threshold excitation can be obtained by equating input magnetic flux to that of Parmentier's pulse. Finally an *R-T* junction has been realized by resistive coupling of two neuristor lines and used to introduce a circulating pulse onto a storage ring. (auth)

9194 STRIPLINE COUPLING TO JOSEPHSON OSCILLATORS. Ganz, T.; Mercereau, J.E. (California Institute of Technology, Low Temperature Physics 63-37, Pasadena, Californa 91125). J. Appl. Phys. 46: No. 11, 4986-4988 (Nov 1975).

The observation and analysis of self-induced steps in the current-voltage characteristics of superconducting quantum interference bridges, strongly coupled to superconducting microstrip cavities, are reported. A two-fluid model is used to analyze the results and estimate the amplitude of the oscillating supercurrent in the GHz range as a function of critical current. (auth)

9195 EFFECT OF PHASE-DEPENDENT CONDUCTIVITY ON INDUCTIVE WEAK LINKS. Blackburn, J.A. (Physics Department, Wilfrid Laurier University, Waterloo, Ontario, Canada); Nerenberg, M.A.H.; Forsyth, P.A. Jr. J. Appl. Phys. 46: No. 12, 5315-5316 (Dec 1975).

The effect of the cosϕ term on the current-voltage characteristics of a Josephson weak link is calculated for a device with negligible capacitance but finite inductance. (auth)

9196 NEW EFFECT IN JOSEPHSON MIXING OF A SUBMILLIMETER LASER SIGNAL AND A MICROWAVE SIGNAL. Henningsen, J.O.; Lindelof, P.E.; Steingrimsson, B.S. (Physics Laboratory I, H.C. Ørsted Institute, University of Copenhagen, Denmark). Appl. Phys. Lett. 27: No. 12, 702-704 (15 Dec 1975).

An oscillatory quasiperiodic structure is observed in the *I-V* characteristic of a Josephson point contact irradiated by a 525.5-GHz submillimeter laser signal and a 4.5-GHz microwave signal. Solving the resistively shunted Josephson (RSJ) model by a novel approach, in which the supercurrent is treated as a perturbation, the structure is shown to result from higher-order mixing processes. (auth)

9197 TERMINATION FOR SUPERCONDUCTING POWER TRANSMISSION SYSTEMS. Forsyth, E. B.; Jensen, J. E. (to U. S. Energy Research and Development Administration). US Patent 3,902,000. H02G15/22. 26 Aug 1975. Filed Date 12 Nov 1974. 16p.

PAT-APPL-523,182.

This patent relates to a cold, electrical gradient, terminal section for a superconducting cable for alternating current power transmission. A cold electrical gradient section filled with a gaseous coolant acting as an insulator is provided in series with a separate thermal gradient section. (auth)

9198 ELECTRICALLY INSULATING FEED-THROUGH FOR CRYOGENIC APPLICATIONS. Bemberger, J. A.; Brown, D. P.; (to U. S. Energy Research and Development Administration). US Patent 3,904,815. H01B17/26; H01L39/02. 9 Sep 1975. Filed Date 17 Sep 1974. 4p.

PAT-APPL-506,818.

This patent relates to an electrical connector (suitable for cryogenic applications) of virtually all metal construction employing anodized aluminum rings to provide electrical isolation. (auth)

9199 SOLENOIDS OF COMPOSITE CONDUCTOR SIMULATE AC LOSSES IN FLEXIBLE SUPERCONDUCTING CABLE. Carter, C. N.; Sutton, J. (Central Electricity Research Labs., Leatherhead, Eng.). Cryogenics; 15: No. 10, 599-607(Oct 1975).

The complex current distribution on the individual strands of a flexible superconducting cable influences the ac loss. Hence reliable loss predictions cannot be made from previous measurements. It is shown that the required current patterns and losses can be simulated by winding the conductor into single or double layer solenoids. Both total and localized losses can be measured with suitably arranged voltage probes. Measurements have been made on five different strip conductors wound into single layer solenoids to simulate losses on the inner conductor of a flexible cable. Measurements on niobium clad copper composite conductor showed that edge losses contributed more to the total loss than had been predicted theoretically for an idealized case. Despite this the total losses averaged only 15 mW m^{-2} at 40 A mm^{-1} rms, at 4.2 K. Measurements were also made on a Nb/Nb-25% Zr/Cu conductor, developed to carry fault currents in the NbZr and fabricated by soldering together Nb clad NbZr and Nb clad Cu composites. At fields below about 100 A mm^{-1} rms, currents were carried by the niobium surface layer and at higher fields flux penetrated into the NbZr underlayer. Thus losses were acceptably low over the entire field range. (auth)

Heat Transfer and Fluid Flow

Refer also to abstracts 9213, 11268, and 11367.

9200 (JUL-1134-AT) NUMERICAL TREATMENT OF HEAT CONDUCTION PROBLEMS WITH THE HELP OF FINITE ELEMENTS IN THREE DIMENSIONS. Leyers, H. J. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralabteilung Allgemeine Technologie). Nov 1974. 34p. (In German). Dep. NTIS (US Sales Only) $5.00.

It is shown how the finite element method can be used to obtain approximate solutions of the heat conduction equation λ divgrad $T + q_v = 0$ in three dimensions. Either the temperature or the heat flux or a natural heat exchange with the environment was assumed as a boundary condition. The calculation method is explicitly carried out for cylindrical geometry and explained in an appendix with a numerical example calculated with the FORTRAN program HEAT. (tr-auth)

9201 (SAND-75-8733) ROUGH WALL TURBULENT HEAT TRANSFER WITH VARIABLE VELOCITY, WALL TEMPERATURE, AND BLOWING. Coleman, H. W.; Pimenta, M. M.; Moffat, R. J. (Sandia Labs., Livermore, Calif. (USA)). Nov 1975. Contract AT(29-1)-789. 10p. (CONF-760102-2). Dep. NTIS $4.50.

From 14th AIAA aerospace sciences meeting; Washington, District of Columbia, USA (26 Jan 1976).

An integral prediction method is presented which accurately describes Stanton number behavior for a fully rough turbulent boundary layer flowing over a uniformly rough surface. The kernel function which represents the response of such a system to an unheated starting length is shown to also describe the response to variations in freestream velocity, surface temperature and blowing. Predictions are compared with experimental data for cases of variable wall temperature, favorable pressure gradients and variable blowing. Agreement is excellent in all cases. (auth)

9202 NUMERICAL STUDY OF PULSATILE FLOW THROUGH CONSTRICTED ARTERIES. Daly, B. J. (Los Alamos Scientific Lab., N. Mex. (USA)). pp 117-124 of Proceedings of the Fourth International Conference on Numerical Methods in Fluid Dynamics. Richtmyer, R. D. (ed.) (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics). Heidelberg; Springer (1975).

From 4th international conference on numerical methods in fluid dynamics; Boulder, Colo. (24 Jun 1974). 4 figs.; 5 refs.

Numerical techniques for the solution of a wide variety of problems in fluid dynamics are discussed. (GE)

9203 CONTRIBUTION TO THE BOILING CURVE OF SODIUM. Schins, H. E. J. (Commission of the European Communities, Ispra (Italy). Div. of Technology). Atomkernenergie; 26. No. 1, 48-52(1975).

8 figs.; 5 tabs.; 21 refs.

Sodium in a pool was preheated to saturation temperatures at system pressures of 200, 350, and 500 torr. A test section of normal stainless steel was then extra heated by means of the conical fitting condenser zone of a heat pipe. Measurements were made of heat transfer fluxes, q in W/cm^2, as a function of wall excess temperature above saturation, $\Theta = T_w - T_s$ in °C, both in natural convection and in boiling regimes. These measurements make it possible to select the Subbotin natural convection and nucleate boiling curves among other variants proposed in literature. Further it is empirically demonstrated on water that the minimum film boiling point corresponds to the homogeneous nucleation temperature calculated by the Doering formula. Assuming that the minimum film boiling point of sodium can be obtained in the same manner, it is then possible to give an approximate boiling curve of sodium for the use in thermal interaction studies. At 1 atm the heat transfer fluxes q versus wall temperatures Θ are for a point on the natural convection curve 0.3 W/cm^2 and 2°C; for start of boiling 1.6 W/cm^2 and 6°C; for peak heat flux 360 W/cm^2 and 37°C; for minimum film boiling 30 W/cm^2 and 905°C, and for a point on the film boiling curve 160 W/cm^2 and 2,000°C. (auth)

9204 COLLAPSE OF VAPOR BUBBLES IN A LIQUID. Khabeev, N. S. Fluid Dyn. (USSR) (Engl. Transl.); 8: No. 6, 891-894(1973).

Translated from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza; 8: No. 6, 50-54(1973).

The effect of nonequilibrium phase transitions on the vibrations of a vapor bubble in a liquid caused by a suddenly applied pressure drop is considered. This problem is of interest in the study of mixed liquid and vapor flows with a discrete vapor phase. Results are presented of a numerical solution of this problem in the form of dimensionless radius–time curves for various values of the parameter which characterizes the kinetics of the phase transitions. The case of equilibrium phase transitions and the thermal and dynamic interactions of a gaseous bubble with the surrounding fluid are considered in the literature cited. (auth)

9205 EFFECT OF HUMIDITY ON THE FLOW CHARACTERISTICS OF A TWO-PHASE MEDIUM IN A DIFFUSER. Ignat'evskaya, L. A.; Seleznev, L. I. Fluid Dyn. (USSR) (Engl. Transl.); 8: No. 6, 886-890(1973).

Translated from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza; 8: No. 6, 44-49(1973).

The effect of the initial humidity of a two-phase flow on the aerodynamic characteristics of a diffuser is considered. A series of calculations was carried out that permitted the pressure distribution in the diffuser to be investigated in the case of change of the initial flow velocity, coefficient of slip of the phases, and the initial humidity of the flow. It is shown that, with an increase of the initial humidity in the diffuser, there appears a sharply expressed region which has a negative pressure gradient, where the steam velocity can reach the critical value. The numerical solution is compared with the experimental results. (auth)

Materials Testing

9206 (EUR-5090) STUDY OF GAMMASCOPE FOR HEAVY GAUGE PRODUCTS. Arnoult, J.; Wanin, M. (Commission of the European Communities, Brussels (Belgium)). Feb 1973. 24p. (In French). INIS.

6 refs.; 2 tabs.; 7 figs. Also published in German, English.

The study was made using the USINOR gammascopic probing installation at Longwy and the IRSID procedure. The installation used has been in operation for seven years for the systematic control of the plant production. The gauges studied were in the range of 220 to 300 mm. After a brief review of the characteristics of the installation and some operational data, the principal conclusions drawn from the examination of heavy gauge products are reported. These conclusions were drawn primarily from an evaluation of tests on thicknesses between 220 and 250 mm. Nevertheless the examination (not actually completely in a definitive manner) of products having a gauge up to 300 mm seems to indicate that the conclusions made are general. (tr-INIS)

9207 (ORNL-5099) NONDESTRUCTIVE TESTING DEVELOPMENT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 30, 1975. Hill, M. R. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 55p. AT.

Results collected during the period from July 1 to Oct. 1, 1975, in all nondestructive testing development programs sponsored by the Division of Reactor Research and Development of ERDA are reported. The results were obtained by the Argonne National Laboratory, General Electric Co., Hanford Engineering Development Laboratory, and Oak Ridge National Laboratory. (LCL)

9208 (UCRL-Trans-10728) SOUND EMISSION ANALYSIS: A NEW NON-DESTRUCTIVE TESTING PROCESS. Eisenblaetter, J. Translated from Ing.-Dig.; 11: No. 10, (1972). 20p. Dep. NTIS $4.50.

Sound emission analysis is based on the following phenomenon: the sliding processes which take place during the deformation of a metal or the cracks growing in a material send out sound impulses whose frequencies range up to the ultrasound region. These sound impulses are measured with sensitive piezoelectric receivers. If several receivers are attached, e.g. to a large pressure vessel which is under stress by inner pressure, then it is possible to establish the time differences of the sound impulses among the different receivers and thus localize a crack as a source of sound, similar to the way in which the origin of an earthquake is determined. The deployment of sound emission analysis to a non-destructive test-procedure has already advanced so far that a number of interesting applications exist. This paper will describe the investigation of plastic deformation in metals, the localizing of flaws in the pressure test of large boilers, the discovery of evidence of special type of crack formation in tension arm annealing (underplating cracks) and the differentiation of various rupture processes in plastic strengthened by glass fibers. (auth)

9209 CERTAIN POSSIBILITIES FOR THE USE OF PSEUDONOISE CODING AND DECODING OF THE IMAGES AND VIDEO SIGNALS IN RADIATION DEFECTOSCOPY. Novik, D. A. (Special Designs Office of X-ray Apparatus, Leningrad). Sov. J. Nondestr. Test. (Engl. Transl.); 11: No. 1, 1-7(1975).

Translated from Defektoskopiya; 11: No. 1, 7-15(1975).

An attempt was made to apply the technique of pseudonoise coding and decoding of images and video signals in order to form and analyze images in radiation defectoscopy. It is shown that by using this technique one may resolve the principal information problems and contradictions arising from the special characteristics of penetrating radiations, as encountered in the shadow method of obtaining images in radiation defectoscopy and also in the method of recording the images of penetrating radiation sources with a camera obscura. (auth)

9210 HUNGARIAN ROLLIX X-RAY EQUIPMENT FOR PANORAMIC EXAMINATION OF TUBE BUTT WELDS. Tibor, K. (Budapest Polytechnical Inst.). Sov. J. Nondestr. Test. (Engl. Transl.); 11: No. 1, 103-105(1975).

Translated from Defektoskopiya; 11: No. 1, 122-124(1975).

The Rollix x-ray equipment emits radiation in all directions. The 360° beam emerging from a reasonably small focal spot enables one to examine a whole joint in a single exposure requiring 1 to 5 min. with films of strip or roll form. (TFD)

9211 MULTILAYER COMPONENT CHECKING WITH FAST AND THERMAL NEUTRONS. Elagin, V. B.; Pekarskii, G. S.; Pakhomov, Yu. P.; Chislov, N. N.; Kurapov, V. N. (Electronic Flaw Detection Research Inst., Tomsk, USSR). Sov. J. Nondestr. Test. (Engl. Transl.); 11: No. 1, 19-21(1975).

Translated from Defektoskopiya; 11: No. 1, 28-32(1975).

The method was proved by inserting Lucite rods into copper tubes of various diameters and wall thicknesses. Neutrons from a ^{252}Cf source gave clear pictures of 1.8 mm holes in the Lucite rods when placed between two steel plates of 4 mm thickness. X-ray methods did not reveal such defects. (TFD)

9212 NONDESTRUCTIVE TESTING OF NARROW-GAP WELDED JOINTS USING RADIOGRAPHIC AND ULTRASONIC METHODS. Steffens, H. D.; Henderson, I. D.; Echterhoff, U. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Bremen (F. R. Germany). Inst. fuer Angewandte Materialforschung). Z. Werkstofftech.; 6: No. 5, 160-163(May 1975). (In German)

4 figs.; 9 refs.

The intensified demand for economical sources of electrical energy has led to nuclear power plants with increasingly larger pressure vessels, particularly for BWR and PWR installations. The wall thicknesses of these vessels now exceeds 200 mm. The fabrication of these heavy structural components to close construction tolerances has required the development of economic welding processes, which in general are fully mechanized. One such process which has been successfully applied to the joining of heavy sections is Narrow-Gap welding. Investigations on Narrow-Gap welded joints using conventional nondestructive testing methods, such as radiographic and ultrasonic methods, have revealed that weld defects in these weld seams can be readily determined since for this process, the possible zones of weld failures are clearly defined over a very small region. The assessment of the test results according to accepted standards for pressure vessel construction has revealed that providing the welding conditions are carefully controlled, acceptable weld quality is ensured. (auth)

Nuclear Explosions

Refer also to abstracts 9278, 9279, 9284, 9285, 9298, 9491, 9507, and 9956.

9213 (LA-6014) NUMERICAL METHOD FOR STUDYING THE CIRCULATION PATTERNS OF A FLUID IN A CAVITY. Stephani, L. M.; Butler, T. D. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1975. Contract W-7405-ENG-36. 40p. Dep. NTIS $4.00.

The method incorporates three circulation-inducing mechanisms: (1) buoyancy induced by nonuniform initial distribution of heat throughout the fluid, (2) buoyancy induced by removal of heat from the fluid, and (3) forced convection induced by withdrawal of heated fluid and return of cooled fluid. A two-dimensional computer program, CIRCO, based on the Marker-and-Cell (MAC) technique, is used to study the circulation patterns. The report discusses the code and illustrates its capabilities by means of examples from studies conducted for the Pacer project, which investigates the concept of producing electrical power from energy released by thermonuclear explosions in a salt dome. Efficient engineering

for withdrawing energy from the cavity requires an understanding of the circulation patterns of the heated fluid. CIRCO provides this information in the form of computer-generated plots. (auth)

9214 (STI/PUB-414) PEACEFUL NUCLEAR EXPLOSIONS. IV. Proceedings of a Technical Committee Meeting held in Vienna, 20-24 January 1975. Panel Proceedings Series. (International Atomic Energy Agency, Vienna (Austria)). 1975. 488p. (In several languages). (CONF-750109-). IAEA $30.00.

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975).

Separate abstracts were prepared for the 28 papers included. (CH)

For abstracts of individual papers see: 9218-9239, 9278, 9279, 9284, 9285, 9507, and 9594.

9215 (TID-26882) SEISMIC ATTENUATION STUDIES AT THE IDAHO NATIONAL ENGINEERING LABORATORY. Navarro, R. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA). Idaho National Engineering Lab.). 1975. Contract AT(10-1)-1502. 73p. Dep. NTIS $5.50.

Five high explosive shots ranging in size from 1,005-16,005 lbs (M/sub L/ of ~0.1 to 2.0) were detonated at the Idaho National Engineering Laboratory (INEL) between May 15 and October 17, 1974. These detonations were part of INEL's program, conducted by the United States Geological Survey, to determine the seismic attenuation characteristics in the vicinity of the laboratory. Particle velocity time histories generated by the 5 shots were recorded by L-7 systems deployed at 22 of the 23 temporary locations having a distance range of 0.42-62.9 km from the energy source. In addition, a magnitude (m/sub b/) 6.1 teleseism in the Kuril Islands was recorded at 7 locations. Two important results which have a bearing on the features of the design earthquake response spectra for INEL were obtained: (1) the experimental data suggest that peak particle velocity (and probably acceleration) attenuates more rapidly (i.e., as $R^{-2.1\pm}$) in the vicinity of INEL than in other geographic areas of the United States and (2) the seismic response of sites off-Snake River Plain is significantly greater over a wide range of frequencies than the response of sites on-Snake River Plain. Additional experimental data are needed to improve the precision of these preliminary results. (auth)

9216 (UCRL-76887) PATTERN RECOGNITION AT LAWRENCE LIVERMORE LABORATORY. Bender, C. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 May 1975. Contract W-7405-Eng-48. 6p. (CONF-750565-1). Dep. NTIS $4.00.

From pattern recognition workshop; Washington, District of Columbia, USA (1 May 1975).

Possible uses of pattern recognition techniques for solving complex scientific problems are discussed, and previous experience in using the pattern recognition computer code RECOG to solve materials problems, specifically in determining the mechanical properties of high explosives, is described. (LCL)

9217 (USGS-474-217) DETERMINATION OF IN SITU STRESS AT U12e.18 WORKING POINT, RAINIER MESA, NEVADA TEST SITE. Miller, C. H.; Miller, D. R.; Ellis, W. L.; Ege, J. R. (Geological Survey, Denver, Colo. (USA)). Dec 1975. 24p. Dep. NTIS $4.00.

A three-dimensional determination of stress beyond the influence of tunnel openings was done in U12e.18 drift, Nevada Test Site. The measurements were made with a three-component borehole deformation gage, using an overcoring procedure developed by the U.S. Bureau of Mines. The principal compressive stress magnitudes and directions, as well as compressive and shear stress components along the north-south, east-west, and vertical directions, were calculated from the measurements. The magnitude and orientation of the maximum principal stress are 1,006 pounds per square inch and S. 4^0 W.; of the intermediate principal stress, 864 pounds per square inch and S. 28^0 W.; and of the minimum principal stress, 404 pounds per square inch and S. 75^0 E. Potential planes of fracture caused by rock yielding in tension, which could result from either nuclear detonations or hydraulic fracturing, are estimated from the principal stresses to strike about N. 14^0 E. and dip about 78^0 NW. Horizontal stresses were measured that are higher than can be explained from simple gravity loading. (auth)

9218 AUSTRALIA. Wilson, A. R. W. (Australian Atomic Energy Commission, Coogee, New South Wales). pp 3 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

The national program of Australia related to peaceful uses of nuclear explosions consists of following developments in other countries. (LCL)

9219 FRANCE. Sarcia, A. J. (CEA, Paris). pp 5-6 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975). (In French)

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

The French national program on peaceful uses of nuclear explosions is outlined. (LCL)

9220 FEDERAL REPUBLIC OF GERMANY. Langer, M. (Bundesanstalt fuer Bodenforschung, Hanover). pp 7-8 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

The German Federal Republic has no plans for peaceful uses of nuclear explosives within its territory but continues to be a consultant to the IAEA on large-scale construction projects which might use nuclear explosives. (LCL)

9221 INDIA. Chidambaram, R. (Bhabha Atomic Research Centre, Trombay, India). pp 9 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

Reference is made to the peaceful nuclear explosion experiment carried out in India on May 18, 1974. (LCL)

9222 SWEDEN. Ericsson, U. (Royal Ministry for Foreign Affairs, Stockholm). pp 11 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

The Swedish government has no program for peaceful uses of nuclear explosions, but participates in efforts in the UN and CCD towards disarmament and non-proliferation. (LCL)

9223 THAILAND. Srisukh, S. (Office of Atomic Energy for Peace, Bangkok). pp 13 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

Thailand is considering the feasibility of using nuclear explosives for excavating a sea-level canal and for in-situ extraction of shale oil. (LCL)

9224 UNION OF SOVIET SOCIALIST REPUBLICS. Myasnikov, K. V. (Pavlik Morosov Inst. of Physics, Moscow). pp 15-16 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

The national program of the USSR on peaceful uses of nuclear explosions is summarized. (LCL)

9225 UNITED KINGDOM. Parker, K. (Atomic Weapons Research Establishment, Aldermaston, Eng.). pp 17-21 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

Although no nuclear explosion uses are envisioned for the British Isles, research continues in support of IAEA activities in the peaceful nuclear explosions field. (LCL)

9226 UNITED STATES OF AMERICA. Fleming, E. H. (Atomic Energy Commission, Washington, DC). pp 23-25 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

Developments in US programs for evaluating peaceful uses of nuclear explosions, specifically for shale oil and mineral recovery and for natural gas production stimulation, are briefly described. (LCL)

9227 PROJECT RIO BLANCO. Part I. Nuclear Operations and Chimney Re-entry. Woodruff, W. R.; Guido, R. S. (Univ. of California, Livermore). pp 29-116 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

Rio Blanco was the third experiment in the USAEC's Plowshare Program to develop technology to stimulate gas production from

geologic formations not conducive to production by conventional means. The project was sponsored by CER Geonuclear Corporation with the Lawrence Livermore Laboratory providing the explosives and several technical programs, such as spall measurement. Three nuclear explosives, specifically designed for this application, were detonated simultaneously in a minimum-diameter emplacement well using many commercially available components of established reliability. The explosive system performed properly under extreme temperature and pressure conditions. Emplacement and stemming operations were designed with the aim of simplifying both the emplacement and reentry, and fully containing the detonation products. An integrated command and control system was used with communication to all three explosives through a single coaxial cable. Reentry and the initial production testing have been completed. To date 98 million cubic feet at STP (2.78×10^6 m^3 (STP)) of chimney gas has been produced. (auth)

9228 PROJECT RIO BLANCO. Part II. Production Test Data and Preliminary Analysis of Top Chimney/Cavity. Toman, J. (Univ. of California, Livermore). pp 117-140 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

The reentry drilling established communication with the top Rio Blanco detonation region at a depth of 1704 m, or about 76 m above the top detonation center. A total of 2.8×10^6 m^3 (97×10^6 ft^3) of dry gas at standard conditions has now been produced during two separate test periods. Radioactive and chemical analysis of this gas and the modeling of the stimulated reservoir shows the following main results: no permeable connection exists between the top and the middle detonation regions, since none of the tracer incorporated in the center explosive canister was detected in the gas produced. As a consequence, results for the top detonation region only are available at this time; the initial cavity radius is deduced to be 20 m (66 ft), or well within expectations; integration of the ^{85}Kr produced indicates a yield of 34 +- 3 kt for the top explosive; of the approximately 1000 Ci of tritium produced in the top explosion region, about 5 percent is incorporated in the gas phase; pressure draw-down and build-up data are best reproduced by a two-layer reservoir model showing stimulated permeabilities about 10 and 30 times original formation permeabilities, and extending to a distance of about three cavity radii from the well bore; and the capacity of the reservoir intercepted by the top explosive is deduced to be about 0.2 mdarcy · m (0.73 mdarcy · ft), as contrasted with preshot estimates ranging from 1.3 to 2.3 mdarcy · m (4.1 - 7.6 mdarcy · ft). The reason for this discrepancy is not resolved at this time. Additional subsurface investigations of the other detonation regions as well as a reevaluation of the initial reservoir properties are in progress. (auth)

9229 SOME POSSIBLE APPLICATIONS OF PEACEFUL NUCLEAR EXPLOSIONS IN THE RECOVERY OF NATURAL RESOURCES FROM BENEATH THE SEABED. Parker, K. (Atomic Weapons Research Establishment, Aldermaston, Eng.). pp 141-151 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

The technical, economic and environmental advantages and disadvantages of using nuclear explosions as an aid to recovering natural resources from beneath the seabed are discussed and compared with those in applications on land. Particular consideration is given to their use in assisting petroleum production as offshore development moves into deeper waters. (auth)

9230 NUCLEAR IN SITU RECOVERY OF OIL FROM OIL SHALE. Lewis, A. E. (Univ. of California, Livermore). pp 153-207 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

A plan is presented for production of oil by retorting oil shale in situ after breaking it with underground nuclear explosives. Reserves of oil shale of thickness and grade suitable (greater than 20 gal/ton) for this process occur in the Piceance Creek Basin of Colorado, and are estimated to contain 640×10^9 barrels of oil in place. Cost projections indicate that this oil could be produced at a price ranging from $2.00 to $3.30 at the well head with a 20 percent rate of return on investment (discounted cash flow). The price and production rate vary with oil shale thickness. At a rate of 32 nuclear chimneys per year in oil shale ranging in thickness from 1000 to 2000 ft, production varies from 28×10^6 bbl/a ($3.30/bbl) to 121×10^6 bbl/a ($2.00/bbl). Capital requirements for this in situ process are estimated to be 20 times less than those required by a surface retorting process. Environmental problems such as the need to dispose of large volumes of waste rock associated with conventional mining and surface retorting of oil shale would be largely avoided. De-watering problems would be similar to those associated with other methods of development. Problems of seismic ground motion and possible contamination of the oil and groundwater appear manageable. Because of its potential economic and environmental advantages, it is believed that this method should be considered for development of this vast resource. (auth)

9231 THAILAND'S KRA CANAL PROJECT. Preliminary Assessment of the Feasibility of Nuclear Excavation of a Part of the Canal Route. Srisukh, S. (Office of Atomic Energy for Peace, Bangkok). pp 209-225 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

For more than 200 years the need for a canal across the Isthmus of Kra to link the Gulf of Thailand with the Andaman Sea had been discussed. This man-made waterway was to be entirely on Thai soil and subject to Thai sovereignty. The first comprehensive prefeasibility survey of such a sea-level canal was completed in September 1973. This study, authorized by the Thai Government of the period and prepared by four American consultant firms, was financed entirely by the private sector. It concluded that the 102-km-long canal, with its related industrial zones and deep-water ports, was feasible from an engineering standpoint and could be economically viable using a combination of public and private financing. The survey recommended that the optimum design to meet the demands of maritime commerce in the 21st Century was one which would accommodate tankers of 500,000 dwt capacity one-way, west to east. This would cost US $5.6 billion (US 1973 dollars) with conventional construction, would take 12 y to complete, and would require the excavation of some 2.8×10^9 m^3 of earth, making it the largest engineering project in the world. As a possible method of saving both money and time, the consultants were asked to examine the feasibility of using modern nuclear engineering technology to excavate 45 km of almost the western half of the canal. They reported that within the limitations of the prefeasibility study, there were no technical, safety or operational factors which would preclude the successful implementation of the PNE portion of the project. Nuclear engineering would permit savings of over US $2 billion and would shorten construction time by some 2 to 4 y. As of this date, the consultants' 600-page report is in the Thai Government's possession. No decision has yet been made as to how to proceed with the project or whether or not the use of PNE is a practical option in the light of current world perspectives. (auth)

9232 USE OF CONTAINED NUCLEAR EXPLOSIONS TO CREATE UNDERGROUND RESERVOIRS, AND EXPERIENCE OF OPERATING THESE FOR GAS CONDENSATE STORAGE. Kelrovskii, O. L.; Myasnikov, K. V.; Leonov, E. A.; Romadin, N. M.; Dorodnov, V. F.; Nikiforov, G. A. (State Committee for Utilization of Atomic Energy, Moscow). pp 227-256 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975). (In Russian)

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

Investigations on the creation of underground reservoirs by means of nuclear explosions have been going on in the Soviet Union for many years. Three main kinds of sites or formations that can be used for constructing reservoirs by this method, namely, low-permeable rocks, worked-out mines, and rock salt formations are considered. Formulas are given for predicting the mechanical effect of an explosion in rocks, taking their strength characteristics into account. Engineering procedures are described for sealing and restoring the emplacement holes, so that they can be used for operating the underground reservoir. Experience with the construction and operation of a 50,000 m^3 gas-condensate reservoir in a rock salt formation is described. In the appendix a method is presented for calculating the stability of spherical cavities created by nuclear explosions in rock salt, allowing for the development of elasto-plastic deformations and creep. (auth)

9233 IN SITU LEACHING OF A COPPER DEPOSIT BROKEN DOWN BY PNE. Braun, R. L. (Univ. of California, Livermore); Lewis, A. E.; Mallon, R. G.; Sisemore, C. J.; Tewes, H. A.; Hard, R. A.; Klumpar, I. V.; Petrovic, L. J. pp 257-282 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

Copper recovery using nuclear rubblization and in-situ leaching has been studied to estimate the economic feasibility and to identify problem areas for future research and development. A plan for commercializing this chemical mining process was built around a

detonation schedule of ten chimneys every three years, a leaching cycle of six years, and an annual copper production of 40,000 t. The results show that recovery using this method is profitable for a type of deposit that would be unprofitable by any conventional method. The release of radioactivity from the chimney during reentry and leaching operations, and the contamination of groundwater and copper product were studied. A careful estimate of expected radiological exposures to plant workers and to the public indicates that all exposures will be below established guidelines. (auth)

9234 POSSIBLE TECHNICAL APPROACHES TO THE ESTABLISHMENT OF SAFETY STANDARDS FOR CARRYING OUT PEACEFUL NUCLEAR EXPLOSIONS. Grechushkina, M. P.; Izrael, Yu. A.; Petrov, V. N. (State Committee for Utilization of Atomic Energy, Moscow). pp 377-388 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975). (In Russian)

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

It is proposed that radioactive fall-out at great distances from the explosion centre, where large numbers of people may reside and be exposed to minute doses of irradiation, should be taken into account in establishing safety standards for nuclear cratering explosions. As far as the technical approach to the establishment of such standards is concerned, the authors suggest that the maximum permissible doses adopted should be some small fraction of the genetic dose and critical organ doses recommended by the ICRP, plus a small fraction of the dose from natural radiation. Moreover, fall-out of the long-lived nuclides ^{90}Sr and ^{137}Cs should not lead to any increase in the ^{90}Sr and ^{137}Cs levels already present because of nuclear weapons tests in the past; on the contrary, the trend towards a reduction of those levels should continue. Present radiation conditions and some problems of predicting radioactive fall-out at large distances are considered. It is shown that the use of explosive charges commensurate with present technology would allow certain projects requiring nuclear cratering explosions to be carried out under satisfactory conditions from the standpoint of radiation protection. (auth)

9235 EVALUATION OF POSSIBLE RESIDUAL STRESSES IN A ROCK MASSIF AFTER AN EXPLOSION. Rodionov, V. N.; Sizov, I. A.; Tsvetkov, V. M. (State Committee for Utilization of Atomic Energy, Moscow). pp 391-398 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975). (In Russian)

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

The effect of the stressed state of the unbroken mass left behind after an explosion is considered for different media. An evaluation is made of possible residual stresses and their distribution in the zones of elastic and inelastic deformation. The process of self-propagation of an explosion in an inhomogeneous anisotropic medium or in a medium with an inhomogeneous stress field is also considered. (auth)

9236 ROW-CHARGE NUCLEAR CATERING EXPLOSION IN ALLUVIAL ROCKS. Kireev, V. V.; Kedrovskii, O. L.; Valentinov, Yu. A.; Myasnikov, K. V.; Nikiforov, G. A.; Prozorov, L. B.; Potapov, V. K. (State Committee for Utilization of Atomic Energy, Moscow). pp 399-419 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975). (In Russian)

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

A brief description is given of the first row-charge nuclear cratering explosion in alluvial rocks carried out on the route of the Pechora-Kolva canal. The purposes of the explosion are described along with the geological conditions, the emplacement parameters and yields of the charges, present data on the dynamics of development of the explosion and its seismic effects. The parameters of the resulting trench cut and the characteristics of the rock ejecta are also given. The possibility of using nuclear explosions for hydrotechnological projects requiring large excavations in a thick stratum of weak water-bearing rocks is considered. (auth)

9237 SOME STUDIES ON INDIA'S PEACEFUL NUCLEAR EXPLOSION EXPERIMENT. Chidambaram, R.; Ramanna, R. (Bhabha Atomic Research Establishment, Trombay, India). pp 421-436 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

Many potential industrial and engineering uses of peaceful nuclear explosions have been recognized. Applications like stimulation of oil reservoirs and mining of non-ferrous metals are promising in the context of Indian conditions. As a step towards studying fracturing effects in rocks, ground motion, containment of radioactivity and the problems involved in post-shot access of the shot-point environment, a peaceful nuclear explosion experiment was carried out underground in the Rajasthan desert on May 18, 1974. The plutonium device was emplaced at a depth of 107 m in shale in a chamber at the end of an L-shaped hole. The ground above the emplacement point rose with an initial spall velocity of about 30 m/s to form a dome 170 m in diameter and 34 m in height. High-speed photographs showed that the mound remained essentially intact during its growth and fall. As an important part of the public and environmental safety programme for the experiment, several meteorological stations, one of them very near the experiment site, were set up well before the date of the experiment. The wind direction at the time of the experiment was from WSW at a mean speed of about 20 km/h. The experiment was planned and executed at a time when this wind direction was very constant and the other meterological conditions were favorable so that in the event of unexpected venting of radioactivity and the formation of a radioactive cloud the direction of cloud travel would have been towards uninhabited regions in the ENE sector. However, atmospheric pressure measurements by ground-level barographs within a few kilometres from Surface Ground Zero gave no indication of any air blast due to escaping cavity gases. Extensive radiation monitoring of the site and analysis of air samples before and after the experiment showed that no radioactivity had been released to the atmosphere during the experiment. The average of seismic magnitudes obtained at seismological observatories scattered over the world works out to 5.0 on the standard Richter scale. The yield of the experiment is estimated at about 12 kt. The experiment produced an apparent crater of average radius 47 m and depth 10 m below pre-shot ground surface, in agreement with observations made on tests elsewhere. Post-shot drilling operations at the experiment site are in progress. It is clear from bore hole gamma logs and radiochemical measurements on the rock samples obtained from the bore holes that all the residual radioactivity from the experiment is buried deep underground. No radioactivity has been encountered closer than 30 m to the post-shot ground surface or in vertical bore holes located farther than 80 m from Surface Ground Zero. (auth)

9238 PEACEFUL NUCLEAR EXPLOSIONS AND THERMODYNAMICS. Prieto, F. E. (National Univ. of Mexico, Mexico City). pp 437-440 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

Some theoretical advances in the thermodynamics of very high pressures are reviewed. A universal (system-independent) formulation of the thermodynamics is sketched, and some of the equations more frequently used are written in system-independent form. Among these equations are: Hugoniot pressure and temperature as functions of volume; the Mie-Gruneisen equation; and an explicit form for the equation of state. It is also shown that this formalism can be used to interpret and predict results from peaceful nuclear explosions. (auth)

9239 MODEL RESEARCH ON THE CRUSHING EFFECT OF EXPLOSIONS. Lukishov, V. G.; Rodionov, V. N.; Sizov, I. A.; Tsvetkov, V. M. (State Committee for Utilization of Atomic Energy, Moscow). pp 441-450 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975). (In Russian)

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

Experimental data on the crushing of rosin blocks under shock compression are reported. It is shown that fracturing of the material takes place at the wave front in the shock-wave amplitude range of 6 to 25 kbar, and that the destruction front begins to lag behind the wave front when the wave amplitude falls below 6 kbar, while still retaining a steady propagation velocity down to 2 kbar. The observed type of destruction, propagated as a crushing front, is thought likely to play a decisive role as the scale of the explosion increases. (auth)

Protective Structures and Equipment

9240 (LA-6074-PR) MULTIPLE HEPA FILTER TEST METHODS, JULY 1, 1974–MARCH 31, 1975. Schuster, B. G.; Osětek, D. J. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1975. Contract W-7405-ENG-36. 8p. Dep. NTIS $4.00.

A laboratory apparatus has been constructed for testing two HEPA filters in a series configuration. The apparatus consists of

an instrumented wind tunnel in which the HEPA filters are mounted, and an auxiliary wind tunnel for obtaining diluted samples of the challenge aerosol upstream of the first filter. Measurements performed with a single particle aerosol spectrometer demonstrate the capability for measuring overall protection factors of greater than 2.5×10^8. The decay of penetration as a function of time in individual HEPA filters indicates no preferential size discrimination in the range of 0.1 mu m to 1.0 mu m; nor is there a preferential size discrimination of penetration in this same range. A theoretical feasibility study has been performed on the use of an inhomogeneous electric field/induced aerosol electric dipole interaction for potential use as an air cleaning mechanism. Numerical evaluation of a coaxial cylinder geometry indicates that the method is feasible for collection of particles down to 0.1 mu m under typical airflow velocity conditions. Small modifications in the geometry may be incorporated to create an instrument capable of measuring particle size. Geometries other than coaxial cylinders are also under investigation. (auth)

9241 (UCID-16949-75-3) ENHANCED FILTRATION JULY–SEPTEMBER 1975 PROGRESS REPORT. Project No. 3026. Nelson, G. O.; Richards, C. P. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Nov 1975. Contract W-7405-Eng-48. 18p. Dep. NTIS $4.00.

Progress during July to October 1975 in improving the service life of high-efficiency particulate air filters is described. The design and operation of filter testing equipment including sodium chloride aerosol generator, particle agglomerator, electronic differential pressure manometer, and flame photometric sodium detector are discussed. (LCL)

Safety Engineering

9242 (LA-6120-PR) VENTILATION SYSTEMS ANALYSIS DURING TORNADO CONDITIONS. Progress Report, January–June 1975. Bennett, G. A.; Gregory, W. S.; Smith, P. R. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1975. Contract W-7405-ENG-36. 22p. Dep. NTIS $4.00.

The principal concern of this investigation is to develop the capability to simulate the dynamic effects of a tornado depressurization on a ventilation system. The basic formulation and solution of the two-zone series model ventilation subsystem is based on lumped parameter component response equations, the isothermal compression of air, and the conservation of mass. Solutions based on these assumptions are also presented for the two-zone series model with natural bypass, the two-zone series model with recirculation, and the natural branching model. A parameter study is presented comparing the effects of changes in system resistance, system capacitance, and variable tornado depressurization rates. The adaptability of the basic formulation to adiabatic compression of air and the addition of duct resistance is examined. A quasi-steady formulation is introduced and preliminary considerations of the importance of inertia are presented. Preliminary conclusions in this area indicate that inertial effects can be neglected. For relatively long ducts slow shock development appears possible. Work on the effect of tornado depressurization rates as related to shock development and on the importance of inertia effects is continuing. (auth)

Vacuum Engineering

9243 (AD-751331) APPARATUS FOR ULTRAHIGH-VACUUM IN SITU THIN-FILM STUDIES. Chase, W. R.; Prell, R. A.; Ruf, F. X. (Systems Research Labs., Inc., Dayton, Ohio (USA)). 4 May 1970. Contract F33615-67-C-1312. 5p. NTIS.

An apparatus to permit in situ studies of thin-film devices in a linear ultrahigh vacuum system is described. The apparatus is compatible with vacuum to 10^{-12} power torr and temperatures to 450°C. (auth)

9244 VAKUUMNYE SISTEMY ELEKTROFIZICHESKIKH USTANOVOK. (Vacuum Systems for Electrophysical Installations). Glazkov, A. A.; Malyshev, I. F.; Saksaganskii, G. L. Moscow; Atomizdat (1975). 192p.

Principles of operation, technology, and calculations are presented for vacuum systems used in electrophysical equipment. The requirements for the vacuum in charged-particle accelerators and thermo-nuclear equipment are discussed, and the construction details of recent vacuum systems are given. The construction of a vacuum chamber and shielding and of special construction-engineering instrumentation are described. The principal properties of vacuum materials are considered. (191 references) (tr-auth)

ENVIRONMENTAL AND EARTH SCIENCES

9245 (ORO-748) OAK RIDGE RESERVATION LAND-USE PLAN. (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Aug 1975. 70p. Dep. NTIS $5.50.

This document, along with the base map and overlay maps, provides a reasonably detailed description of the ERDA Oak Ridge land resources and of the current and potential uses of the land. A description of the land characteristics, including geomorphology, agricultural productivity and soils, water courses, vegetation, and terrestrial and aquatic animal habitats, is presented to serve as a resource document. Essentially all ERDA land in the Oak Ridge area is being fully used for ongoing ERDA programs or has been set aside as protected areas. As is evident from the plan, much of the land is in multiple program use. Of the 37,000 acres (14,800 ha) presently in the Oak Ridge reservation, some 1500 acres (4 percent) are protected from activities that would alter the land's unique character. Selective disposals, compatible with AEC program requirements and totaling some 21,000 acres (36 percent of the original reservation), began in 1949 and have continued to the present. Because the expanded role of ERDA over that of the AEC is resulting in additional land-use needs, further disposals of land must be carefully evaluated. ERDA program needs may require the acquisition of additional land. Continued requests for transfer of ERDA land holdings can be expected from local, county, and state governments as well as from other government agencies and private individuals and organizations. Requests are prompted by the need for land for such things as residential, recreational, and industrial development, highway easements, electrical transmission-line corridors, and sanitary landfill sites. Such requests for land must be critically evaluated in terms of the potential impact on current and future ERDA programs. Intensified use of existing land resources must be anticipated, and options for expansion or addition of new ERDA facilities must be recognized, including sufficient land for waste-management activities. Moreover, biomedical and environmental research programs require undisturbed watersheds, terrestrial and aquatic animal habitats, and land capable of agricultural production. (auth)

9246 (UCRL-51444-75) PROGRAM REPORT: FY 1975, ATMOSPHERIC AND GEOPHYSICAL SCIENCES DIVISION, PHYSICS DEPARTMENT. Knox, J. B.; Orphan, R. C. (eds.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Oct 1975. Contract W-7405-Eng-48. 34p. Dep. NTIS $5.00.

The FY 1975 research program conducted by the Atmospheric and Geophysical Sciences Division and supporting segments at Lawrence Livermore Laboratory is reviewed briefly. Specific projects are described, and significant findings of the work are indicated. Unique numerical modeling capabilities in use and under development are described. Applications in regional atmospheric modeling, the San Francisco Bay area air pollution model, studies on the climatic effects of nuclear explosions, research on precipitation scavenging, and studies of the interaction of wind and surface dust are discussed. (CH)

Minerals and Ores

Refer also to abstracts 8828, 8841, 11391, and 11415.

9247 (CEA-CONF-3025) NOTES ON URANIUM GEOCHEMISTRY APPLIED TO THE STUDY OF INTERGRANITIC DEPOSITS AND THEIR ENVELOPE. Carrat, H. G. (CEA Direction des Productions, 92-Chatillon (France)). 1975. 37p. (In French). INIS.

From colloquium of the French Geological Society on metallogenetics; Orleans, France (3 Mar 1975).

Research on the natural state of uranium, either in the form of traces in the crystal structure or in intergranitic pitchblende deposits is presented. In the former case the methods considered are those relative to post-magma development, a phenomenon having well established connections with the crystallization of uranite type ores. This can be interpreted as a preconcentration if certain genetics concepts are adopted. New aspects of these relationships will then be reported. In the latter case two kinds of research will be presented, corresponding to two types of hypotheses. First, the laying down of pitchblendes by supergenesis is based on the easy degradation of uraninite under meteoric conditions, which will be considered in the geochemical and paleogeographical contexts. Second, the hydrothermal nature of pitchblendes will find strong support in experimental studies on the fluid inclusions of the ore, its matrix and its immediate envelope and from considerations on depth tectonics. (FR)

9248 (FES-75-94) FINAL ENVIRONMENTAL STATEMENT OF THE APPROVAL BY THE DEPARTMENT OF THE INTERIOR OF A LEASE OF THE UTE MOUNTAIN UTE TRIBAL LANDS FOR URANIUM EXPLORATION AND POSSIBLE MINING. (Bureau of Indian Affairs, Albuquerque, N. Mex. (USA)). 21 Nov 1975. 164p. Bureau of Indian Affairs, Albuquerque, NM.

The proposed action is the approval by the Department of the Interior of a lease of Ute Mountain Ute Tribal lands for the purpose of exploration and possible mining of uranium and related minerals. The lease area is entirely located on the Ute Mountain Ute Reservation Montezuma County in southwestern Colorado. The proposed project would consist of a four-year exploration phase, a four-year development phase, and an approximate twelve years of mining and possible processing. The entire project is based on the assumption that exploration will reveal commercial ore bodies that will be mined by underground methods. Radon gas will be one of the air pollutants. Surface erosion in selected areas will occur. The biological community will be impacted to some degree in selected areas. The aesthetics of the area will be noticeably impacted adversely. (auth)

9249 (GJO-1627(Pt.1)) INVESTIGATION OF ALASKA'S URANIUM POTENTIAL. Eakins, G. R. (Alaska State Dept. of Natural Resources, College (USA). Div. of Geological and Geophysical Surveys). 1 Jun 1975. Contract AT(05-1)-1627. 445p. Dep. NTIS $12.75.

Of the various geographical regions in Alaska that were examined in an exhaustive literary search for the possibility of uranium--either vein type or sedimentary--six offer encouragement: the Copper River Basin, the alkaline intrusive belt of west-central Alaska and Selawik Basin area, the Seward Peninsula, the Susitna Lowland, the coal-bearing basins of the north flank of the Alaska Range, the Precambrian gneisses of the USGS 1:250,000 Goodnews quadrangle, and Southeastern Alaska, which has the sole operating uranium mine in the state. Other areas that may be favorable for the presence of uranium include the Yukon Flats area, the Cook Inlet Basin, and the Galena Basin. (auth)

9250 (GJO-1627(Pt.2)) INVESTIGATION OF ALASKA'S URANIUM POTENTIAL. Part II. Map of the Granitic Rocks of Alaska. Regional Distribution and Tectonic Setting of Alaskan Alkaline Intrusive Igneous Rocks. Forbes, R. B. (Alaska Univ., College (USA). Geophysical Inst.). 1 Jun 1975. Contract AT(05-1)-1627. 160p. Dep. NTIS $7.75.

The regional distribution and tetonic setting of alkaline intrusive igneous rocks in Alaska are described. A map of granitic rocks in the state is included. (LK)

9251 (GJO-1635-1) MULTISPECTRAL PROCESSING OF ERTS-A (LANDSAT) DATA FOR URANIUM EXPLORATION IN THE WIND RIVER BASIN, WYOMING: A VISIBLE REGION RATIO TO ENHANCE SURFACE ALTERATION ASSOCIATED WITH ROLL-TYPE URANIUM DEPOSITS. Final Report, June 1974–July 1975. Salmon, B. C.; Pillars, W. W. (Environmental Research Inst. of Michigan, Ann Arbor (USA)). Jul 1975. Contract AT(05-1)-1635. 129p. Dep. NTIS $7.00.

The purpose of this report is to document possible detection capabilities of the LANDSAT multispectral scanner data for use in exploration for uranium roll-type deposits. Spectral reflectivity, mineralogy, iron content, and color parameters were measured for twenty natural surface samples collected from a semiarid region. The relationships of these properties to LANDSAT response-weighted reflectances and to reflectance ratios are discussed. It was found that the single ratio technique of multispectral processing is likely to be sensitive enough to separate hematitic stain, but not limonitic. A combination of the LANDSAT $R_{5,4}$ and $R_{7,4}$ ratios, and a processing technique sensitive to vegetative cover is recommended for detecting areas of limonitic stain. Digital level slicing of LANDSAT $R_{5,4}$ over the Wind River Basin, after geometric correction, resulted in adequate enhancement of Triassic redbeds and lighter red materials, but not for limonitic areas. No recommendations for prospects in the area were made. Information pertaining to techniques of evaluating laboratory reflectance spectra for remote sensing applications, ratio processing, and planimetric correction of LANDSAT data is presented qualitatively. (auth)

9252 URANIUM DEPOSITS IN SOUTH AMERICA. Brazil, Chile, and Columbia Are Urging on Prospection. Metall; 29: No. 7, 732-734(Jul 1975). (In German)

Estimates of uranium ore deposits in Brazil, Chile, and Columbia and prospecting projects are reported. (GE)

9253 RAW MATERIAL URANIUM. Arnold, O. (Rheinische Braunkohlenwerke A. G., Koeln (F. R. Germany)). Brennst.-Waerme-Kraft; 27: No. 6, 239-244(Jun 1975). (In German)

8 figs.; 5 tabs.; 7 refs.

Some aspects are considered, in as far as they can contribute to a better understanding of uranium as a raw material and as an energy carrier, and as they can indicate the possible ways and means open to the German Federal Republic for securing this highly desirable raw material, without becoming even more dependent on the economic and political views of the producing countries, than it is the case with respect to oil. (auth)

9254 SWEDISH URANIUM SUPPLY CAN BE MADE SECURE FOR 200 YEARS. Andersson, A.; Olsson, G. Tek. Tidskr.; 105: No. 5, 17-19(14 Mar 1975). (In Swedish).

Studies made since 1950 of the low-grade uranium deposits at Ranstad and the surrounding district in central Sweden have now resulted in a commercial extraction process. Extraction of uranium for the Swedish nuclear power industry is being undertaken by a consortium. An annual production of 1275 tons of uranium from 6 million tons of schist is planned. Some details of the extraction process are given. (SW)

9255 RADIOACTIVE DISEQUILIBRIA IN BRAZILIAN CALDASITE. Curtius, A. J. (Pontificia Univ. Catolica, Rio de Janeiro). Inorg. Nucl. Chem. Lett.; 11: No. 12, 841-845(Dec 1975).

It is of general interest, from different points of view, whether high chemical resistance also means a good preserving matrix for radioactive decay products. Looking for radioactive equilibria is a proper method to prove that. Under this aspect, samples of caldasite (a mixture of zircon ($ZrSiO_4$) and baddeleyite (SiO_2) occurring in Pocos de Caldas, Brazil) were analyzed for Ra, Pb, and U by means of separations, α and β countings and x-ray fluorescence as well. Experimental results are presented and discussed. (auth)

Radioactivity Monitoring and Transport

Refer also to abstracts 9292, 9352, and 9422.

9256 (AECL-5254, pp 25-46) ENVIRONMENTAL RESEARCH BRANCH. Ophel, I. L. Sep 1975.

In Biology and Health Physics Division progress report, April 1–June 30, 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Progress is reported on the following research projects: sublethal effects of heated-water on aquatic organisms; beneficial uses of waste heat; aquatic radioecology and freshwater biology; St. Lawrence river studies; radiation effects; Perch Lake studies; atmospheric diffusion studies; neutron activation analysis; waste management; natural deuterium concentrations in the vicinity of the La Prade heavy-water plant; environmental isotope hydrology of ground water systems; gamma dose rates at the CRNL boundary; off-site monitoring; liquid effluent monitoring; liquid disposal area; and tritium survey. (HLW)

9257 (ARH-2068) MOISTURE MOVEMENT IN SOILS ON THE HANFORD RESERVATION. Brownell, L. E.; Isaacson, R. E.; Sloughter, J. P.; Veatch, M. D. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 15 Apr 1971. Contract AT(45-1)-2130. 20p. Dep. NTIS $4.50.

Methods being studied are as follows: the thermodynamic method based on water potential and thermocouple psychrometers; the tracer method using atmospheric tritium; the annual water balance based on the annual heat balance; the field lysimeter using thermocouple psychrometers; the influence of soil breathing as a result of changes in barometric pressure; and the influence of soil stratification. Progress to date has involved the installation of thermocouple psychrometers from the surface to the water table 310 feet below. These instruments are in the process of equilibration. Isothermal methods of analyzing water potential must be extended to include nonisothermal conditions which are dominant at the Hanford Reservation. Tracer techniques using tritium analyses of soil samples have successfully demonstrated that archaic water exists in virgin soil at the Hanford Reservation from a depth of approximately 7 meters to the water table, indicating that percolation has been limited to lesser depths. The annual heat balance indicates that quantities of water many times greater than the annual average precipitation of 16 centimeters can be evaporated from the soils at the Hanford Reservation during a normal summer. This indicates that the critical precipitation (P/sub c/) value may be greater than 30 to 50 centimeters of water. More precise values of the Bowen's ratio for the Hanford Reservation are required to refine this computation. The field lysimeter is perhaps the most direct method of determining the critical precipitation values for the Hanford Reservation but as yet has not been used. (auth)

9258 (CONF-751105-9) PLUTONIUM AND AMERICIUM IN LAKE MICHIGAN SEDIMENTS. Edgington, D. N.; Alberts, J. J.; Wahlgren, M. A.; Karttunen, J. O.; Reeve, C. A. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 14p. (SM-199/47). Dep. NTIS $4.50.

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, California, USA (17 Nov 1975).

The vertical distributions of $^{239,240}Pu$, ^{238}Pu, and ^{137}Cs have been measured in sediment cores taken from Lake Michigan. Sections from a limited number of cores have been analyzed for ^{241}Am. In addition, grab samples from ten locations in the southern basin of the lake have been analyzed for phase distribution of $^{239,240}Pu$ using a sequential extraction technique. The results indicate that the $^{239,240}Pu$, ^{238}Pu, and ^{137}Cs from weapons testing, and the ^{241}Am formed in situ are concentrated in the sediments. A comparison of the total deposition of $^{239,240}Pu$ and ^{137}Cs indicates that ^{137}Cs may be valuable as a monitor for $^{239,240}Pu$ deposition in the sediments. Values of the $^{238}Pu/^{239,240}Pu$ ratio are in agreement with values reported in Lake Ontario sediments (and Lake Michigan plankton) and show little variation with depth. ^{241}Am data support the concept of in situ production with little preferential mobility after formation. Studies of sedimentary phase distributions show that $^{239,240}Pu$ is associated with hydrous oxide phases which are chemically stable under the prevailing conditions in lake sediments. Since Lake Michigan sediments remain aerobic, relatively little $^{239,240}Pu$ is available for chemical mobilization from the hydrous oxide or organic phases present in the sediments. (auth)

9259 (ORO-4066-7) INVESTIGATION OF THE UNUSUAL BEHAVIOR OF CESIUM-137 AND OTHER RADIONUCLIDES IN THE FLORIDA ENVIRONMENT. Progress Report, September 1, 1972–September 1, 1975. Gamble, J. F.; Ewel, K. C.; Lugo, A. E. (Florida Univ., Gainesville (USA). Inst. of Food and Agricultural Sciences). 1975. Contract E(40-1)-4066. 106p. Dep. NTIS $6.50.

Levels of fallout ^{137}Co in southeastern Florida milk indicate milk drinkers in the area have ingested 17 mrem in excess of the national average in the period 1963 to 1973. Analysis of feed in dairy rations in the area show a transfer of seven percent of activity from feed to milk. Range cattle had five times the cesium activity as meat from dairy animals. The increased amount of hay in the ration, plus higher activity levels in the unimproved pasture, account for the increase. Eighty percent of the original fallout is still active in the southeastern Florida biosystem. (auth)

9260 (RISO-323) ENVIRONMENTAL RADIOACTIVITY IN DENMARK IN 1974. Aarkrog, A.; Lippert, J. (Danish Atomic Energy Commission, Risoe. Research Establishment). June 1975. 113p. Dep. NTIS (US Sales Only) $6.50.

Data are presented on the content of fallout ^{137}Cs and ^{90}Sr in various foods and estimates on content in the human diet in Denmark in 1974. (CH)

9261 (RISO-324) ENVIRONMENTAL RADIOACTIVITY IN FAROES IN 1974. Aakrog, A.; Lippert, J. (Danish Atomic Energy Commission, Risoe. Research Establishment). Jul 1975. 25p. Dep. NTIS (US Sales Only) $4.25.

Measurements of fall-out radioactivity in the Faroes in 1974 are presented. Strontium-90 (and ^{137}Cs in most cases) was determined in regularly collected samples of precipitation, grass, milk, fish, sea water, bread, and drinking water. In addition, analyses were made of spot samples of lamb, potatoes, sea plants, vegetables, eggs, and human bone. Estimates are given of the mean contents of ^{90}Sr and ^{137}Cs in the human diet in the Faroes in 1974. Whole body measurements were made on six individuals from the Faroes. (auth)

9262 (RISO-325) ENVIRONMENTAL RADIOACTIVITY IN GREENLAND IN 1974. Aarkrog, A.; Lippert, J. (Danish Atomic Energy Commission, Risoe. Research Establishment). Jul 1975. 20p. Dep. NTIS (US Sales Only) $4.25.

The ^{90}Sr fall-out rates at various locations in Greenland are presented for 1974. The food consumed in Greenland in 1974 contained on the average 4.8 pCi $^{90}Sr/g$ Ca, and the daily mean intake of ^{137}Cs was estimated at 54 pCi. The most important ^{90}Sr contributors to the diet were grain products and milk products, together accounting for approximately 65% of the total ^{90}Sr content of the diet, while ^{137}Cs originated mainly from meat (reindeer and lamb) and fish, which contributed 90% of the total ^{137}Cs content of the diet. (CH)

9263 PREDICTIVE CAPABILITIES OF THE SPECIFIC ACTIVITY HYPOTHESIS FOR Cs AND Zn IN FRESHWATER SYSTEMS. Seelye, J. G. East Lansing, MI; Michigan State Univ. (1975). 131p. University Microfilms Order No. 75-20,888.

Thesis (Ph. D.).

Predictions of radioisotope concentrations in components of aquatic systems have been attempted using the specific activity concept, an approach that seems theoretically sound. A comprehensive examination of the specific activities of ^{134}Cs and ^{65}Zn in the components of a freshwater system, over a 10 month period, was conducted to evaluate the specific activity hypothesis under applied conditions. This study was designed to provide comparisons of predicted and observed specific activities and to test the equivalence of specific activities between all components of the system. One dose of radioisotopes was added to the system in this study and even after 10 months these radioisotopes were not distributed similarly to the stable isotopes. This suggests that the time necessary to reach a specific activity equilibrium might be a matter of years rather than months. More importantly, in natural systems, where the radioisotope addition is continuous a specific activity equilibrium may never be achieved. These things plus the non-conservative nature of the ^{134}Cs and ^{65}Zn predicted concentrations indicates that the use of the specific activity concept for predicting radioisotope concentrations of Cs and Zn in freshwater systems is questionable. A more rigorous approach must be used, considering isotope transfer rates between components and the complexity of the system. Problems with statistical comparisons of derived variables, such as specific activities, are discussed and were considered in interpreting the results of this study. (ERB)

9264 EFFECT OF SALINITY AND IONIC EQUILIBRIUM ON THE CONTAMINATION OF ARENICOLA MARINA (ANNELIDE, POLYCHETE). Amiard-Triquet, C. (CEA, Fontenay-aux-Roses, France). J. Exp. Mar. Biol. Ecol.; 15: No. 2, 159-164 (Jun 1974). (In French)

The fixation of ^{137}Cs on fine sand with Arenicola increases when the salinity or K content of the water is decreased. The concentration factors for seawater diluted to 60% or with a K level of 50% were twice that for normal seawater. Several assumptions explain the process: weaker competition between ions at lower concentrations, substitutions of K by Cs, parallel contribution of Cs and K in maintaining the internal environment more hypertonic than the external environment, and contamination via the food chain in desalinated seawater. (Pollut. Abstr.)

9265 AMERICIUM-242m IN NUCLEAR TEST DEBRIS. Bowen, V. T.; Livingston, H. D. (Woods Hole Oceanographic Inst., MA). Nature (London); 256: No. 5517, 482(7 Aug 1975).

It is stated that it would be expected to find all three of the long-lived Am nuclides—^{241}Am, ^{242m}Am, and ^{243}Am—in the debris from nuclear explosions. Weapons grade Pu is always contaminated with ^{241}Am, and this nuclide has an appreciable cross section for neutron capture leading to ^{242}Am; about 10% of such captures yield ^{242m}Am, the others passing to the ground state. A small but readily measurable amount of ^{242}Cm has been found in seawater that had been contaminated by close-in fallout from a low yield nuclear test carried out in 1962, and it is concluded that the ^{242}Cm observed was the daughter of ^{242m}Am produced in the original nuclear explosion, probably by neutron capture by ^{241}Am. It should be practicable to measure ^{242m}Am in a variety of other samples by searching for ^{242}Cm supported by a longer-lived precursor. Some interesting consequences of the measurable production of ^{242m}Am in nuclear tests are mentioned, including environmental mobility effects. It is finally concluded that ^{242m}Am will be a significant component of the debris from future nuclear tests, or peaceful nuclear explosions, but will diminish with increasing use of breeder reactor Pu. It is thought that a careful search for ^{242m}Am should be made in environmental monitoring, both to establish data on its present distribution in nature, and to establish limits on its influence on the environmental behavior of its descendants ^{242}Cm and ^{238}Pu. (UK)

Atmosphere

Refer also to abstracts 9479, 9480, 9491, 9700, 11331, 11341, 11344, and 11351.

9266 (CONF-760202-3) GUIDELINES FOR CLEANUP OF URANIUM TAILINGS FROM INACTIVE MILLS. Goldsmith, W. A.; Haywood, F. F.; Jacobs, D. G. (Oak Ridge National Lab., Tenn. (USA)). 1975. 8p. Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

Recent experiences in Grand Junction, Colorado, have indicated the significance of uranium tailings as sources of nonoccupational exposure and suggest that current methods for perpetual care and isolation of the large areas covered by tailings piles at inactive mill locations may be inadequate for minimizing human exposure. This paper presents the rationale and the procedures used in reviewing the adequacy of proposed criteria for remedial action at these sites. Exposures due to aquatic, terrestrial, airborne, and direct contamination pathways were compared to determine the most important radionuclides in the pile and their pathways to man. It is shown that the most hazardous components of the tailings are ^{226}Ra and ^{230}Th. The long half-lives of these radionuclides require the consideration of continuous occupancy of the vacated site at some future time, even if the immediately projected land use does not anticipate maximum exposure. (auth)

9267 (CONF-760202-4) DETECTION OF INTERNALLY DEPOSITED ACTINIDES. Part II. Statistical Techniques and Risk Analysis. Goans, R. E. (Oak Ridge National Lab., Tenn. (USA)). 1975. 7p. Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

Since a considerable number of workers at Oak Ridge National Laboratory work with compounds of the transuranic elements, computer techniques have been developed to evaluate phoswich spectra in order to determine lung burdens following accidental inhalation of ^{239}Pu, ^{241}Am, ^{244}Cm or other isotopes. Two unfolding methods which have been found useful in the analysis of such cases are presented and discussed. These techniques have been used successfully to detect low levels of ^{239}Pu, ^{241}Am, ^{244}Cm, ^{233}U, ^{90}Sr, and ^{153}Gd in contaminated workers; but because of the current importance of ^{239}Pu, emphasis is placed on detection of that isotope in the presence of ^{241}Am and natural human background. In the health physics tradition of emphasizing benefit vs. risk, we also analyze uncertainties inherent in external counting of the actinides from the viewpoint of statistical risk analysis and derive decision criteria which are useful in determining whether various radioactive species have, in fact, been detected. These criteria are somewhat different from those encountered using traditional counting statistics and derive from the realization that some errors will always be made in scanning large numbers of radiation workers. The optimum decision strategy for the determination of lung burden is, therefore, one which minimizes the long-term risk of error. The usefulness of this approach to whole body counting will be discussed and analyzed. (auth)

9268 (CONF-760202-14) ENVIRONMENTAL MONITORING OF ^{41}Ar. Sasscer, D. S.; Andreu, C. (Puerto Rico Nuclear Center, Mayaguez). 1975. 2p. Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

The Draft Standard for Restrictions on Radioactive Effluents from Research Reactors of June 1974 recommends that the allowable concentration in unrestricted areas be reduced by a factor of fifty to 8×10^{-10} mu Ci/cc. The objective of this investigation was to develop a simple and accurate procedure for measuring argon-41 in unrestricted areas when this radioactive noble gas exists in concentrations significantly below the new recommended allowable concentration. These measurements were made in order to provide an accurate and simple verification of the results obtained when using prediction models for the spatial variation of the concentration of gases released from a source. The ability to measure argon-41 at a concentration which is less than 2 percent of the previously allowable value required the development of a high-sensitivity radiation detection system. The system which was developed consisted of: connecting a four inch by four inch and a three inch by a three inch sodium iodide detector in parallel; measuring concentrated samples of air in scuba tank filled to 2,200 psi by means of a high pressure pump; and obtaining low radioactive background by locating the detectors and scuba air samples tank in a lead cave with six inch thick walls. (auth)

9269 (NERC-LV-539-10) REPORT OF ANIMAL INVESTIGATION PROGRAM ACTIVITIES FOR THE BANFBERRY EVENT. Smith, D. D.; Black, S. C.; Giles, K. R.; Moghissi, A. A. (Environmental Protection Agency, Las Vegas, Nev. (USA). Environmental Monitoring and Support Lab.). Nov 1975. Contract AT(26-1)-539. 55p. Dep. NTIS $5.45.

On December 18, 1970, an underground nuclear test, conducted at the Nevada Test Site, released radioactive materials into the atmosphere with resultant on-site and off-site contamination. The Animal Investigation Program of the National Environmental Research Center, Las Vegas developed studies to document the distribution of fission and activation products in the tissue of domestic and wild animals residing within contaminated areas on and surrounding the Nevada Test Site. A study of radioiodine secretion in milk from cows at the experimental dairy farm, including urine and fecal excretion from four of them, was started about 24 hours after the venting. A grazing intake study, which utilized fistulated steers, was also carried out. The analytical data collected from these studies are presented in this report. (auth)

9270 (NP-20720) SURVEILLANCE FOR RADIOACTIVITY IN 1973. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-

Roses, 92 (France)). 1973. 71p. (In French). Dep. NTIS (US Sales Only) $5.50.

Data are reported on the radioactivity in the environment of certain countries in South America (Bolivia, Chile, Columbia, Equador, and Peru) and Tahiti and the Wallis Islands in the South Pacific in 1972 due to fallout from French nuclear tests. Data are included on the radioactivity in samples of surface air and the content of ^{90}Sr, ^{137}Cs, and ^{131}I in milk and other biological materials sampled at various locations. (CH)

9271 (SCPRI(RM)-1-1975) MONTHLY PROGRESS REPORT. (Service Central de Protection Contre Les Rayonnements Ionisants, 78-Le Vesinet (France)). Jan 1975. 11p. (In French). INIS.

This monthly report of the SCPRI exposes an interpretation of the principal results concerning the surveillance of radioactivity in the environment: atmospheric dusts (air at ground level, high altitude air), rainwater, surface water, underground water, irrigation water, drinking water, food chain (milk, plants, cattle, fish), seawater around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables (^{7}Be, ^{95}Zr and ^{95}Nb, ^{103}Ru, ^{131}I, ^{137}Cs, ^{140}Ba and ^{140}La, ^{90}Sr, ^{106}Ru and ^{106}Rh, ^{226}Ra, ^{54}Mn, U, and T). A monthly bibliographic selection is also presented. (FR)

9272 (SCPRI(RM)-1-1975(APP.)) APPENDIX TO THE MONTHLY PROGRESS REPORT. Details of the Results of Measurements. (Service Central de Protection Contre les Rayonnements Ionisants, 78-Le Vesinet (France)). Jan 1975. 21p. (In French). INIS.

Measurement tables concerning the surveillance of the environment (see also the SCPRI-RM-1-1975 report). (FR)

9273 (SCPRI(RM)-2-1975(APP.)) APPENDIX TO THE MONTHLY PROGRESS REPORT. Details of the Results of Measurements. (Service Central de Protection Contre les Rayonnements Ionisants, 78-Le Vesinet (France)). Feb 1975. 21p. (In French). INIS.

Measurement tables concerning the surveillance of the environment (see also the SCPRI-RM-2-1975 report). (FR)

9274 (SCPRI(RM)-3-1975) MONTHLY PROGRESS REPORT. (Service Central de Protection Contre les Rayonnements Ionisants, 78-Le Vesinet (France)). Mar 1975. 14p. (In French). INIS.

An interpretation is given of the principal results concerning the surveillance of radioactivity in the environment: atmospheric dusts (air at ground level, high altitude air), rainwater, surface water, underground water, irrigation water, drinking water, food chain (milk, plants, cattle, fish), seawater around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables (^{7}Be, ^{95}Zr and ^{95}Nb, ^{103}Ru, ^{131}I, ^{137}Cs, ^{140}Ba and ^{140}La, ^{90}Sr, ^{106}Ru and ^{106}Rh, ^{226}Ra, ^{54}Mn, U and T). A monthly bibliographic selection is also presented. (FR)

9275 (SCPRI(RM)-3-1975(APP.)) APPENDIX TO THE MONTHLY PROGRESS REPORT. Details of the Results of Measurements. (Service Central de Protection Contre les Rayonnements Ionisants, 78-Le Vesinet (France)). Mar 1975. 24p. (In French). INIS.

Measurement tables concerning the surveillance of the environment are presented. (see also the SCPRI-RM-3-1975 report). (FR)

9276 (UCRL-51886) COMPUTER-CONTROLLED SAMPLING SYSTEM FOR AIRBORNE PARTICULATES. Hall, C. F.; Anspaugh, L. R.; Koval, J. S.; Phelps, P. L.; Steinhaus, R. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Aug 1975. Contract W-7405-Eng-48. 25p. Dep. NTIS $3.50.

A self-contained, mobile, computer-controlled air-sampling system has been designed and fabricated that also collects and records the data from eight meteorological sensors. The air-samplers are activated automatically when the collected meteorological data meet the criteria specified at the beginning of the data-collection run. The filters from the samplers are intended to collect airborne ^{239}Pu for later radionuclide analysis and correlation with the meteorological data for the study of resuspended airborne radioactivity and for the development of a predictive model. This paper describes the system hardware, discusses the system and software concepts, and outlines the operational procedures for the system. (auth)

9277 (UCRL-77106) AMBIENT ENVIRONMENTAL RADIATION MONITORING AT THE LAWRENCE LIVERMORE LABORATORY. Lindeken, C. L.; White, J. H.; Toy, A. J.; Sundbeck, C. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Nov 1975. Contract W-7405-Eng-48. 7p. (CONF-760202-2). Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

Thermoluminescence dosimetry is the principal means of measuring ambient gamma radiation at the Lawrence Livermore Laboratory. These dosimeters are used at 12 perimeter locations and 41 locations in the off-site vicinity of the Laboratory, and are exchanged quarterly. Control dosimeters are stored in a 75-mm-thick lead shield located out-of-doors to duplicate temperature cycling of field dosimeters. Effect of dosimeter response to radiation in the shield is determined each quarter. Calibration irradiations are made midway through the exposure cycle to compensate for signal fading. Terrestrial exposure rates calculated from the activities of naturally occurring uranium, thorium, and potassium in Livermore Valley soils vary from 3 to 7 mu R/hr. Local inferred exposure rates from cosmic radiation are approximately 4 mu R/hr. TLD measurements are in good agreement with these data. Off-site and site perimeter data are compared, and differences related to Laboratory operations are discussed. (auth)

9278 DIFFUSION AND DEPOSITION OF RADIOACTIVE PRODUCTS FROM THE CLOUD OF AN UNDERGROUND NUCLEAR EXPLOSION. Izrael, Yu. A.; Petrov, V. N. (State Committee for Utilization of Atomic Energy, Moscow). pp 355-367 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975). (In Russian)

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

The paper briefly discusses systems for calculating the diffusion and deposition of radioactive products from the cloud produced by an underground cratering nuclear explosion in the near and intermediate fall-out zones, as well as at great distances from the explosion epicentre. The relative quantities of the various radioisotopes injected into such a cloud are given. The systems in question make it possible to calculate the fall-out density of various radioisotopes at different distances from the explosion epicentre, for both dry and wet deposition. (auth)

9279 MODELLING THE DOSE TO MAN FROM EXPOSURE TO TRITIATED WATER VAPOR. Anspaugh, L. R.; Peterson, K. R.; Robison, W. L. (Univ. of California, Livermore). pp 369-376 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

Peaceful Nuclear Explosives (PNE) usually result in the release of tritium as tritiated water vapour (HTO) to the atmosphere. Dose calculations using the deposition velocity-dose conversion constant approach, although valid for most nuclides, have been shown by measurements during flaring of the Rulison gas stimulation experiment to grossly over-estimate tritium doses. This paper presents new, improved methods of calculating the dose to man from the release of HTO. One model is appropriate for the food-chain transfer of HTO under conditions of no or very light precipitation. The primary parameters are the surface air concentration, absolute humidity, and appropriate experimentally-derived constants associated with specific pathways. A key feature of this model is a more realistic treatment of the uptake of HTO by vegetation. The second model is used with light, moderate, or heavy precipitation. The basic equation used for this model expresses wet deposition versus time as a function of cloud thickness, HTO concentration, rain rate, and absolute humidity. Both models appear to give reasonable HTO dose calculations. (auth)

9280 PROBLEMS IN MEASURING PLUTONIUM IN THE ENVIRONMENT. Sill, C. W. (Idaho Operations Office, Idaho Falls). Health Phys.; 29: No. 4, 619-626(Oct 1975).

From proceedings of the second Los Alamos life sciences symposium; Los Alamos, NM, USA (22 May 1974).

Excellent analytical procedures are available for measuring plutonium in all kinds of environmental samples. Conditions are discussed under which complete sample decomposition and exchange with isotopic tracers are obtained, thus ensuring accuracy in the measurements. The major problems arise in obtaining sufficient samples to be statistically representative of the populations involved and in obtaining homogeneous samples for analysis. (auth)

Soil

9281 (RISO-317) NUMERICAL EVALUATION OF THE NATURAL GAMMA RADIATION FIELD AT AERIAL SURVEY HEIGHTS. Loevborg, L.; Kirkegaard, P. (Danish Atomic Energy Commission, Risoe. Research Establishment). Feb 1975. 53p. Dep. NTIS (US Sales Only) $5.50.

In computational studies of the count rates to be expected in

airborne, radiometric surveys of geological formations, knowledge is required of the aerial gamma radiation field produced by the radioactive minerals in the ground. The data presented in this work permits calculation of the energy and angular distribution of the gamma-ray flux at distances of between 0 and 200 m from a plane, homogeneous ground with known abundances of thorium, uranium, and potassium. A tabulation permitting calculation of the gamma dose rate in the air is also given. The data are applicable to any normal ground material (rock or soil) in which uranium and thorium are in secular equilibrium with their respective daughters. Besides, the air density may have an arbitrary variation with the distance to the ground. In calculating the flux of gamma rays that strike an airborne NaI(Tl) detector it is suggested to represent the bottom of the aircraft by an equivalent layer of air. For use in the numerical evaluation of aerial total count rates the angular gamma-ray flux at the point of detection is approximated in accordance with the double-P_1 polynomial expansion method. A detailed tabulation of flux expansion coefficients, calculated for 0.05-MeV wide energy intervals, is presented. To evaluate the differential count rates of high-energy Th-U-K gamma rays, it is convenient to make use of the well-known formulas for a flux of unscattered gamma rays. With this application in view data for insertion in these formulas are also given. (auth)

9282 RADIOAKTIVNYE IZOTOPY V SISTEME POCHVA-RASTENIE. (Radioactive Isotopes in Soil-Plant Systems). Molchanova, I. V.; Kulikov, N. V. Moscow; Atomizdat (1972). 86p.

Problems of migration, distribution dispersion, and fixation of radioactive isotopes of iron, cobalt, yttrium, and cerium in the soil-plant geocenotic chain are considered. Results of study of the sorption of radioisotopes in the soil as a function of various factors (soil type, solution pH, isotope and nonisotope carrier concentrations, and aqueous extracts of fall-out from plants). The strengths of fixation of isotopes in soil are compared, and characteristics of their migration capability in solution-plant and soil-plant systems are presented. Migration and dispersion of radioisotopes in the soil-plant cover of natural and artificial biogenocenosis are considered. 214 references. (tr-auth)

Ecosystems and Food Cycles

Refer also to abstracts 9494 and 9643.

9283 (CEA-R-4705) STUDY OF RADIONUCLIDE TRANSFER BETWEEN INVERTEBRATES AND THEIR MARINE SEDIMENTARY ENVIRONMENT. Amiard-Triquet, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Nov 1975. 98p. (In French). Dep. NTIS (US Sales Only) $6.00.

Thesis. Submitted to Nantes Univ., France.

Radionuclide exchanges between sediment and marine organisms were studied in some benthic marine invertebrates, especially Arenicola marina L. (an Annelid). Experiments were carried out on the transfer of ^{60}Co, ^{137}Cs, and accessorily ^{59}Fe and ^{144}Ce. Water was the chief vector for benthic marine invertebrates. These invertebrates seemed to act mainly in sedimentary areas on the redistribution of adsorbed radionuclides within the sediment. Radioactive contamination of the invertebrates was affected by various physiological or ecological factors. Benthic marine invertebrates were then studied as links in food chains. The transfer of ^{60}Co was studied in three food chains or fractions of food chains. The procedure allowed interesting observations from the health protection point of view and more fundamental investigations on cobalt metabolism (regulation, excretion) in a mollusc, a crustacean, and a teleost. (auth)

9284 POTENTIAL PATHWAYS TO MAN FOR RADIONUCLIDES FROM CONTAINED APPLICATIONS OF PEACEFUL NUCLEAR EXPLOSIVES. Tewes, H. A.; Schwartz, L. L. (Univ. of California, Livermore). pp 297-320 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

The radiological safety of any proposed contained application of peaceful nuclear explosives (PNE) must be carefully evaluated in order to assess the acceptability of such a proposed application. This study considers three possible contained PNE technologies, and examines the potential pathways for exposure of the public to radiation. In order to evaluate the various paths for public exposure to radiation, it is first necessary to understand the pertinent phenomenology of the nuclear explosion. Not only must the chemical and physical properties of cavity and chimney formation be elucidated, but radionuclide source terms for the appropriate nuclear explosive must be generated. The various exposure pathways which must be considered are somewhat specific to the particular application under consideration. Among those which have been explored in some detail in this work are: accidental release of radioactivity at or shortly after detonation; gas releases subsequent to re-entry; occupational radiation exposures; long-term migration of radioactivity in groundwater and population exposure from product-contained radioactivity. For the three PNE applications considered, in all cases, the maximum population doses resulted from the last-cited pathway, i.e. from exposure to product-contained radioactivity. However, potential exposures from this pathway were only a small fraction of currently accepted radiation protection guidelines. (auth)

9285 POTENTIAL PATHWAYS TO MAN FOR RADIONUCLIDES FROM EXCAVATION APPLICATIONS OF PEACEFUL NUCLEAR EXPLOSIVES. Schwartz, L. L.; Tewes, H. A.; Robison, W. L.; Peterson, K. R. (Univ. of California, Livermore). pp 321-342 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

Nuclear explosive excavation is distinguished from other PNE applications by the collateral prompt release of radioactive material. A major consideration in project design is to assure that radiation exposures downwind are kept as low as practicable, as well as below radiation protection guidelines. In addition, application of the technology has international implications in that some of the released radioactivity will be carried across national boundaries, and some will eventually be distributed worldwide. Consequently, the impact of potential radiation exposure resulting from dissemination of radioactive material locally and world-wide must be included in project feasibility evaluations. Thus, excavation projects must be designed to minimize the potential for biological impact through radiation exposure from all significant pathways to man. The basic methods of accomplishing this are: use of explosives specifically designed for excavation with minimum production of biologically significant radionuclides; detonation under preselected meteorological conditions; and temporary predetonation evacuation of people from the close-in downwind sector in order to minimize potential exposures. This report outlines the pathways of potential radiation exposure to man and summarizes the methodology utilized to predict exposures for nuclear excavation projects. An example of predicted exposures for a major excavation project is summarized. (auth)

9286 ^{137}Cs AND ^{40}K IN THE FLESH OF PACIFIC ALBACORE, 1964-1974. Young, D. R. (Southern California Coastal Water Research Project, El Segundo); Folsom, T. R.; Hodge, V. F. Health Phys.; 29: No. 5, 689-694(Nov 1975).

Concentrations of ^{137}Cs in the flesh of albacore tuna caught off the California coast during the last 10 yr decreased by a considerably smaller factor than did corresponding values reported for atmospheric fallout. Between 1965 and 1974, average tissue concentrations decreased steadily from 90 to approx 40 pCi/wet kg, which suggests an effective half-time for ^{137}Cs in the upper layer of the eastern North Pacific of about 1 decade. Values for natural ^{40}K, which was measured at the same time, averaged 3300 pCi/wet kg. The 1965 mean concentrations of ^{137}Cs in albacore from four widely separated fisheries in the Northern Hemisphere agreed within a factor of two, ranging from 50 to 90 pCi/wet kg. In contrast, specimens from South Pacific fishery based at American Samoa averaged only 14 pCi/wet kg. Surface seawater collected around Tutuila Island averaged 0.085 pCi/l. ^{137}Cs, in good agreement with measurements made a year later over a much wider area of the South Pacific. No large variations in flesh concentrations of ^{137}Cs or ^{40}K were observed as a function of tuna size, species, portion of the body sampled, or cooking. Thus, radioanalysis of canned tuna may be an efficient method of following major changes in ^{137}Cs contamination of upper layers of the world ocean. (auth)

9287 PLUTONIUM IN AQUEOUS SYSTEMS. Schell, W. R. (Univ. of Washington, Seattle); Watters, R. L. Health Phys.; 29: No. 4, 589-597(Oct 1975).

From proceedings of the second Los Alamos life sciences symposium; Los Alamos, NM, USA (22 May 1974).

A review has been made of the available information concerning plutonium in the aquatic environment. The levels are low and the data on the environmental concentrations in the lake and marine environment are very limited. Of particular relevance to biological accumulation processes is the physical-chemical state of plutonium. Limited information is available in natural environmental waters. Indications are that the plankton has the highest concentration factors and that the concentration factors decrease with increasing

complexity of the organisms. Recent studies of plutonium in water, sediment, and biota at Bikini and Eniwetok Atolls are given. The water samples measured indicate that plutonium exists in the particulate, soluble, and colloidal physical-chemical states. The plutonium is being injected into the water column from the sediments and has not been removed from the biogeochemical cycle after 16 yr. Concentrations of plutonium in vertebrates and invertebrates measured at Eniwetok were low and ranged from 0.001 to 0.2 pCi/g wet in fish muscle. Additional data are required to better evaluate the potential hazards to man of plutonium in the aquatic environment. (auth)

9288 EVALUATION OF PLUTONIUM AT ENIWETOK ATOLL. Wilson, D. W.; Ng, Y. C.; Robinson, W. L. (Univ. of California, Livermore). Health Phys.; 29: No. 4, 599-611(Oct 1975).

From proceedings of the second Los Alamos life sciences symposium; Los Alamos, NM, USA (22 May 1974).

An extensive survey was carried out in 1972 to 1973 to assess the current radiological status of Eniwetok Atoll. The radionuclides detected in the Atoll environment were studied for their potential contributions to the dose commitment of the returning population according to several pathways of exposure. Plutonium was detected in air and in the terrestrial and aquatic environment at concentrations that varied from background levels due to world-wide fallout to levels several orders-of-magnitude above. The dose commitments from plutonium via the terrestrial food chain and inhalation vary according to the postulated living pattern. The dosages via marine foods can be expected to be insensitive to living pattern and to exceed those via terrestrial foods. Plutonium would contribute nearly all of the dosage via inhalation, but this pathway ranks low in overall importance compared with the food-chain and external-dose pathways. Although the potential dose from plutonium via all pathways is low relative to that from ^{60}Co, ^{90}Sr and ^{137}Cs, plutonium will still remain in the Atoll environment after the other major isotopes have decayed away. (auth)

9289 ENVIRONMENTAL PATHWAYS OF PLUTONIUM INTO TERRESTRIAL PLANTS AND ANIMALS. Hakonson, T. E. (Los Alamos Scientific Lab., NM). Health Phys.; 29: No. 4, 583-588 (Oct 1975).

From proceedings of the second Los Alamos life sciences symposium; Los Alamos, NM, USA (22 May 1974).

In evaluating the occupational environment to assess its hazard potential from the presence of plutonium, measurements must be made on the physical environment and on the worker. The most significant of the former are measurements of plutonium air concentration supplemented by particle size and duration of exposure estimates. These can only be very approximately estimated because of various compromises which must be made and are most useful as indicators of the effectiveness of the containment. Measurements on the worker such as urine assay and chest counting for plutonium also involve compromises and their interpretation involves assumptions based on limited and variable data. Information from analysis of tissue samples shows only a rough correlation with calculations based on urine assay data. Nevertheless, assemblage of all pertinent information from these measurements does permit real control of potential health hazards from work with plutonium. (auth)

9290 STRONTIUM-90 IN HUMAN BONE IN NORWAY 1973. Christensen, G. C.; Pappas, A. C. (Univ. of Oslo). Health Phys.; 29: No. 5, 794-795(Nov 1975).

Continuing measurements of ^{90}Sr content in human vertebrae in Norway are reported. Results of 201 samples from subjects who died in 1973 are tabulated according to the age groups 0 to 14 days (including stillborn), 15 days to 1 yr, > 1 to 5 yr, > 5 to 20 yr and > 20 yr. Geographical distribution of the samples is also presented. The results show a decrease in the ^{90}Sr levels for all age groups compared to 1972. (UK)

9291 TRANSIENT BEHAVIOR OF CADMIUM IN A GRASSLAND ARTHROPOD FOOD CHAIN. Van Hook, R. I.; Yates, A. J. (Oak Ridge National Lab., TN). Environ. Res.; 9: No. 1, 76-83 (Feb 1975).

Biological assimilation and transport of cadmium were determined for an arthropod food chain in an east Tennessee grassland community. Laboratory experiments demonstrated that there were no significant differences (P greater than 0.05) in assimilation rates (17 percent assimilation per day) or biological half-lives (7 days) of ^{109}Cd either as soluble nitrate or insoluble oxide in crickets under identical conditions. Field experiments demonstrated that primary consumers (crickets) accumulated ^{109}Cd much more rapidly (uptake rate equals 0.55 day^{-1}) than did the spider predators (uptake rate equals 0.08 day^{-1}). Equilibrium concentrations in crickets were obtained in 9 days (0.04 ppM cadmium), while equilibrium was not reached in spiders during the 30-day study. Food-chain concentration of cadmium did not occur as crickets accumulated levels of cadmium 60 percent of that in their vegetation food sources and spiders accumulated only 70 percent of the cadmium present in the cricket tissues. (auth)

Radiometric Techniques

Refer also to abstracts 8897 and 9268.

9292 (EGG-1183-1631) RESEARCH PROGRESS IN AIRBORNE SURVEYS OF TERRESTRIAL GAMMA RADIATION. Burson, Z. G. (comp.). (EG and G, Inc., Las Vegas, Nev. (USA)). 4 Jun 1974. Contract AT(29-1)-1183. 30p. Dep. NTIS $4.00.

Progress during the last few years in airborne surveys of terrestrial gamma radiation, i.e. in the measuring, recording, and interpreting of gamma ray signals in NaI(Tl) crystals, is discussed. Non-terrestrial background contributions have been accurately characterized. The feasibility of determining the water equivalent of snow cover by aerial survey techniques has been demonstrated. Repeat surveys over areas surrounding reactor sites can now be used to detect average differences of less than 1.0 mu R/hr in terrestrial gamma radiation levels. New data acquisition and recording systems allow isotope concentrations and total inventories to be measured in spatial resolutions of a few hundred feet. Aerial survey data have been combined with population distribution data to obtain population exposure values from natural terrestrial gamma radiation around reactor sites. (auth)

9293 URANIUM SERIES DATING OF STALAGMITES FROM BLANCHARD SPRINGS CAVERNS, USA. Thompson, G. M. (Memphis State Univ.); Lumsden, D. N.; Walker, R. L.; Carter, J. A. Geochim. Cosmochim. Acta; 39: No. 9, 1211-1218(Sep 1975).

Because stalagmites are enriched in ^{234}U beyond the equilibrium value at the time of deposition, they are potentially datable by measuring their progress toward equilibrium. Procedures for uranium-thorium and uranium disequilibrium dating of speleothems were developed, making use of α spectrometry for thorium determinations and mass spectrometry for uranium determinations. The stalagmites tested were generally beyond the age range of the U-Th age dating method, and, as a result, $^{234}U/^{238}U$ ratios provided the most useful dating technique. The estimated age range for a stalagmite from Blanchard Springs is 135,000 to 785,000 years BP with an interval of slow or suspended growth from about 320,000 to 570,000 years BP. (auth)

9294 PALAEOTEMPERATURES FROM TREE RINGS AND THE D/H RATIO OF CELLULOSE AS A BIOCHEMICAL THERMOMETER. Wilson, A. T.; Grinsted, M. J. (Waikoto Univ., Hamilton, New Zealand). Nature (London); 257: No. 5525, 387-388(2 Oct 1975).

It is stated that if the isotopic ratios of the elements comprising the wood of tree rings gives a record of past climate these may enable a curve of a climatic variable, such as temperature, to be obtained on a time base estimated to be accurate to ± yr. It might be expected that the biochemical pathways leading from Co_2 and water to the compounds making up the wood would show isotopic effects. The question is whether such isotopic effects have significant temperature coefficients; if they do a biochemical thermometer is provided. The existence of such a thermometer is here reported. Experimental work with New Zealand Pinus radiata is reported; this tree grows throughout the year and wide rings are laid down, enabling different parts of the ring, and therefore wood laid down at different temperatures, to be sampled. Plots of the D/H ratios of the cellulose across two rings laid down in 1919-20 by a P. radiata tree growing in New Zealand were determined. This system is at least 30% depleted in summer as compared with winter, and appears to record the annual temperature cycle. It is concluded that the D/H ratio changes with temperature due to temperature effects on one or more of the biochemical reactions leading to cellulose, and the temperature coefficient of such a biochemical thermometer could enable past temperatures to be derived to better than 0.1°C, which should be more than adequate for studying past climatic changes. (UK)

9295 $^{40}Ar/^{39}Ar$ SPECTRUM AGES FOR BIOTITE, HORNBLENDE, AND MUSCOVITE IN A CONTACT METAMORPHIC ZONE. Hanson, G. N.; Simmons, K. R.; Bence, A. E. (State Univ. of New York, Stony Brook). Geochim. Cosmochim. Acta; 39: No. 9, 1269-1277(Sep 1975).

9296 THE STRATIGRAPHIC SIGNIFICANCE OF FISSION-TRACK AGES ON VOLCANIC ASHES IN THE MARINE LATE CENOZOIC OF SOUTHERN CALIFORNIA. Boellstorff, J. D.; Steineck, P. L. (Nebraska Univ., Lincoln (USA)). Earth Planet. Sci. Lett.; 27: No. 2, 143-154(Sep 1975).

Fission-track dates and planktonic microfossil datum levels provide a revised chronology for the marine Late Cenozoic of

southern California. In southern California, the Pliocene/Pleistocene boundary has been placed at the first appearance of Globorotalia truncatulinoides within the Pico Formation, Balcom Canyon, Ventura County. A fission-track age on glass shards from the Bailey Ash close to this level yields a result of 1.12 ± 0.36 m.y.B.P. (millions of years before present). In tropical deep-sea cores, however, G. truncatulinoides has been shown to evolve within the Gilsa Paleomagnetic event with an estimated age of 1.8 m.y.B.P. Thus, the appearance of G. truncatulinoides in southern California is cryptogenic and probably related to the delayed migration into this region of water-mass conditions suitable for this species. Two volcanic ashes from the upper part of the Malaga Formation, Malaga Cove, Los Angeles County, yielded fission-track data on glass shards of 4.42 ± 0.57 m.y.B.P. (lower ash) and 3.364 ± 0.69 m.y.B.P. (upper ash). These dates in addition to inferred paleomagnetic ages of planktonic microfossil datum levels suggest that the Delmontian Stage of California ranges in age from approximately 6 to approximately 3 m.y.B.P. Therefore, the Miocene/Pliocene boundary considered by Berggren and Van Couvering to be approximately 5 m.y.B.P. must lie in the lower Delmontian Stage but paleontologic criteria for its recognition in California are not yet available. (NL)

Site Surveys

Refer also to abstract 9217.

9297 (ANL/AA-2) SITE: A METHODOLOGY FOR ASSESSMENT OF ENERGY FACILITY SITING PATTERNS. Regional Studies Program. Frigerio, N. A.; Habegger, L. J.; King, R. F.; Hoover, L. J.; Clark, N. A.; Cobian, J. M. (Argonne National Lab., Ill. (USA)). Aug 1975. Contract W-31-109-Eng-38. 116p. Dep. NTIS $5.45.

The timely development of the nation's energy production capacity in a manner that minimizes potential adverse local and regional impacts associated with energy facilities requires the use of sophisticated techniques for evaluation of siting alternatives and fuel cycle options. This report is a documentation of the computerized SITE methodology that has been developed for evaluating health, environmental, and socioeconomic impacts related to utilization of alternate sites for energy production within a region of interest. The cost, impact, and attribute vectors, which are generated and displayed on density maps, can be used in a multiparameter overlay process to identify preferable siting areas. The assessment of clustered facilities in energy centers is also possible within the SITE analysis framework. An application of the SITE methodology to Northern Illinois is presented. Also included is a description of the ongoing extension of SITE for the accumulative evaluation of alternative regional energy siting patterns and fuel cycle options. An appendix provides documentation and user information for the SITE computer program. (auth)

9298 (PNE-WW-40) ECOLOGICAL CONSIDERATIONS FOR PROJECT WAGON WHEEL AND HYDRAULIC FRACTURING ACTIVITIES. Phase II(a). Annual Summary Report for 1974. Whicker, F. W.; Alldredge, A. W.; Fisser, H. G.; Post, G. (El Paso Natural Gas Co., Tex. (USA)). Aug 1975. 38p. Dep. NTIS $5.00.

Vegetation studies were conducted to obtain data on production and biomass of shrubs and mat-forming woody plants. Tables are presented to show data for various species of plants. Aquatic studies were conducted to obtain data on benthic fauna and physical water conditions. Tables are presented to show classification of organisms per square foot of river bottom, ice thickness at water sampling locations, and stream velocities along the base of each study bluff. Mammalian studies were conducted to obtain population data on deer, mice, least chipmunk, northern grasshopper, mouse, ground squirrels, and prairie dogs. Observations were also made on antelope, moose, and mule deer. Hydraulic fracturing activities included studies on physical perturbations, vegetation documentation, and small mammal documentation. (HLW)

9299 (UCRL-51948) AVERAGE PROPERTIES OF NUCLEAR TEST AREAS AND MEDIA AT THE USERDA NEVADA TEST SITE. Ramspott, L. D.; Howard, N. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Sep 1975. Contract W-7405-Eng-48. 40p. Dep. NTIS $4.00.

Data have gradually been accumulated on the physical properties of nuclear test sites at the U. S. Energy Research and Development Administration (USERDA) Nevada Test Site (NTS) since underground testing began there in 1957. These data have been stored in the Lawrence Livermore Laboratory (LLL) K-Division Test Effects Data Bank. This report briefly describes the principal test areas (Yucca Flat, Pahute Mesa, and Rainier Mesa) and media (alluvium, tuff, Climax Stock (granite) and Paleozoic rocks) at NTS. Background information is given on the data base and the various methods used to measure geophysical parameters at NTS are described. The mean, standard deviation, and range of values for each test area and medium are given. However, specific properties for individual sites are not contained in this report. Properties for which averages are given include overburden and working-point density; seismic velocity both near the working point and from the working point to the surface; and water content, porosity, and water saturation of the rocks in the working point vicinity. (auth)

9300 (USGS-474-211) SUPPLEMENTARY LITHOLOGIC LOGS AND STRATIGRAPHIC IDENTIFICATIONS FOR EXPLORATORY AND EMPLACEMENT DRILL HOLES IN AREAS 3, 4, AND 7, NEVADA TEST SITE. Dixon, G. L.; Quinlivan, W. D.; Ray, J. M.; Ohl, J. P. (Geological Survey, Denver, Colo. (USA)). Nov 1975. Contract AT(29-2)-474. 93p. Dep. NTIS $5.45.

This report is a supplementary compilation of lithologic logs of exploratory and emplacement holes in Areas 3, 4, and 7, Nevada Test Site, with emphasis on identification of Tertiary volcanic units. An index map showing locations of the drill holes is included. (auth)

9301 EFFECTS OF PARAMETER FLUCTUATION ON RADIOMETRIC MONITORING OF WELDED JOINTS. Volkov, V. F.; Gorbunov, V. I. (Electronic Flaw Detection Research Inst., Tomsk, USSR). Sov. J. Nondestr. Test. (Engl. Transl.); 11: No. 1, 15-18(1975).

Translated from Defektoskopiya; 11: No. 1, 23-28(1975).

A description is given of a method of calculating the relative error in radiometric flaw detection on welded joints. Results are given on the thickness fluctuation in automatically welded joints. The effects of the errors on the sensitivity of the method are examined. (auth)

Thermal Effluents

Refer also to abstracts 9256 and 11358.

9302 (CONF-750692-) PROCEEDINGS OF WORKSHOP ON THE SOCIAL CONSEQUENCES OF WASTE HEAT DISCHARGE ALTERNATIVES, ARGONNE, ILLINOIS, JUNE 9–10, 1975. Butz, B. P.; Lewis, B. A. G.; Friesema, H. P.; Halter, A. N. (Argonne National Lab., Ill. (USA)). Aug 1975. 43p. Dep. NTIS $5.25.

From workshop on the social consequences of waste heat discharge alternatives; Argonne, Illinois, USA (9 Jun 1975).

The workshop was attended by individuals representing federal regulatory and research agencies, universities, private industry, and citizen interest groups. The staff presented papers on quantification of social consequences, environmental considerations, social considerations, and economic considerations. Participant recommendations were made with regard to the impact matrix technique, technology assessment, and the program philosophy. The principal recommendations were that site specific cases be analyzed, careful extrapolation of results be made region by region, generic impact matrices be handled very carefully or avoided, and methodology development be initiated. (HLW)

9303 (SRO-757-5) EFFECTS OF HEATED EFFLUENTS ON THE REPRODUCTION OF SELECTED SPECIES OF THE CENTRARCHID FAMILY. Progress Report, October 26, 1975–October 25, 1976. Clugston, J. P.; Provost, E. E. (Georgia Univ., Athens (USA). School of Forest Resources). 1975. Contract AT(38-1)-757. 9p. Dep. NTIS $4.50.

Progress is reported on the effects of thermal effluents on the development of gametes in the bluegill, Lepomis macrochirus; on uptake of the trace metal contaminants, Cd, Cr, and Pb by fishes; on food habits of the bluegill and the largemouth bass, Microptems salmoides; on the distribution of fishes in cooling reservoirs; and on the behavior of the largemouth bass. (HLW)

9304 INTERACTION BETWEEN THE FUEL-ENERGY COMPLEX AND THE ENVIRONMENT. Styrikovich, M. A. Vestn. Akad. Med. Nauk SSSR; 13-23(Feb 1975). (In Russian)

It is shown that atmospheric heating due to the steadily increasing energy consumption (which presently is a mere 0.02% of the radiation balance of the earth) will not produce any noticeable climatic changes, nor will it constitute any major hazard to the earth's population. In any case, it is negligible as compared to the problem of atmospheric pollution which has become of major concern to humanity. The principal sources of atmospheric pollution are examined, along with the factors responsible for the pollution of rivers, lakes, and oceans. Particular attention is

given to measures that must be taken to prevent pollution due to off-shore drilling. (IAA)

Chemical Effluents

Refer also to abstracts 8828 and 8845.

9305 (UCRL-76198) LIVERMORE REGIONAL AIR QUALITY MODEL (LIRAQ-1). MacCracken, M. C.; Grant, K. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Oct 1975. Contract W-7405-Eng-48. 25p. (CONF-750533-7). Dep. NTIS $4,50.

From first AMS conference on regional and mesoscale modeling analysis and prediction; Las Vegas, Nevada, USA (6 May 1975).

The Livermore Regional Air Quality (LIRAQ) model is an Eulerian grid model developed for use in assessing the regional air quality of a region with temporally and spatially varying meteorology in complex terrain. The first implementation of this approach is embodied in the LIRAQ-1 model and is intended for use with either simple chemical systems or relatively inert pollutants. The basic model formulation is based on the conservation of mass equation integrated vertically from the surface to the base of an inversion layer, thereby creating a single layer model with a grid structure established in the two horizontal dimensions. Surface pollutant concentrations are related to vertical average concentrations using a logarithmic profile. Atmospheric transport, inversion height, source emissions, and topography are all prescribed. Data for the San Francisco Bay Area obtained during 1973 have been used in validation studies. (auth)

INSTRUMENTATION

Radiation Detection Instruments

Refer also to abstract 9190.

General Detectors and Monitors

Refer also to abstracts 9277, 9616, 9647, 9648, 10301, 11264, and 11375–11379.

9306 (AECL–5124, pp 97-110) SOME THEORETICAL ASPECTS OF SELF-POWERED DETECTORS. Lynch, G. F. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed-fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

One of the limitations to further application of self-powered detectors is the lack of a comprehensive theoretical model that accurately predicts detector responses in various radiation environments. The theoretical models that have been put forward in the past few years are reviewed. Progress towards a fully comprehensive treatment of self-powered detector responses is discussed. (auth)

9307 (AECL–5124, pp 111-132) CALCULATIONAL STUDIES OF SENSITIVITY CHARACTERISTICS AND THEIR BURNUP BEHAVIOR FOR RHODIUM SELF-POWERED NEUTRON DETECTORS. Laaksonen, T.; Saastamoinen, J. (Nokia Electronics, Helsinki). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed-fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

A calculational method for determining the sensitivity characteristics and their burnup dependence of beta-current self-powered neutron detectors is described. The method takes into account the spatial distribution of neutron captures in the emitter wire separately for thermal and epithermal neutrons in determining the electron escape efficiency from the emitter wire. Calculational results obtained for a typical rhodium self-powered detector, by using a computer program to implement the method developed, are presented and compared with data published in the literature. Conclusions are drawn about the range of applicability of measured initial sensitivities and their burnup behaviour. (auth)

9308 (AECL–5124, pp 135-149) INITIAL ABSOLUTE CALIBRATION FACTORS OF SOME NEUTRON SENSITIVE SELF-POWERED DETECTORS. Kroon, J. (Reuter Stokes, Cleveland). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed-fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Experimental results obtained in calibrating some neutron sensitive self-powered detectors are presented. Absolute initial sensitivity factors for rhodium, vanadium, and cobalt self powered detectors are given. (WHK)

9309 (AECL–5124, pp 159-174) METHODS USED TO COMPENSATE THE DELAY COMPONENT OF PLATINUM SELF-POWERED DETECTORS. Mercier, P. (Hydro-Quebec, Montreal). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed-fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

The platinum detector has a mixed neutron gamma response that introduces new problems in relating its signal to power. The major drawback to the detector response is the delay component, which is about 20% of the detector signal. This is caused mostly by delayed gammas from fission products. Two methods can be used to compensate for this delay: 1) feedforward compensation, in which the signal of detector is passed through a filter (digital or analog) which has the inverse transfer function of the platinum detector; and 2) feedback compensation, in which the detector signal is made to agree, in long term, with a more accurate power measurement, e.g., thermal measurements. An example of each type of method is presented and their characteristics are discussed. (auth)

9310 (AECL–5124, pp 179-189) EXPERIENCE WITH THE IRRADIATION OF 550°C IONIZATION CHAMBERS. Goodings, A. (Atomic Energy Establishment, Winfrith, Eng.). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed-fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Near core irradiations have been carried out on a number of chambers and it has been shown that lives exceeding 3 years at greater than 500°C in fluxes between $5 \times 10^{9} cm^{-2} sec^{-1}$ and $5 \times 10^{12} cm^{-2} sec^{-1}$ are possible. Test irradiations of this type are, of course, expensive and prolonged. They cannot be repeated very often and the problem now is to control production quality to ensure that future devices meet similar standards. (auth)

9311 (AECL–5124, pp 193-198) MECHANISM FOR GAS LOSS FROM IN-CORE IONIZATION CHAMBERS. Goodings, A. (Atomic Energy Establishment, Winfrith, Eng.). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed-fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

An explanation is given for the initial rapid decrease in sensitivity of dc fission chambers in the DIDO materials testing reactor. It is argued that the fission fragments from the coating of the fission chamber collide with filling gas molecules and drive them deeply into the electrodes. The loss of filling gas and hence nuclear sensitivity occurs. Recovery on shutdown is explained in terms of outgassing effects. (WHK)

9312 (AECL–5124, pp 199-205) EXPERIMENTAL VERIFICATION OF THE GAS PUMPING THEORY WITHIN FISSION IONIZATION CHAMBERS. Bartlett, A. C. (Plessey Co. Ltd., Poole, Eng.). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed-fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

During the development of miniature fission ion chambers for applications as in-core flux monitors for BWR's a loss of detector neutron sensitivity greater than that accountable by fissile coating burnup was discovered. A joint assessment of the phenomenon was undertaken between the United Kingdom Atomic Energy Authority at A.E.E. Winfrith and this Company, which resulted in the theory of gas pumping. This note describes the results of reappraising the experimental data in the light of this theory and attempts to demonstrate that, within the limited accuracy, this theory is substantiated. (auth)

9313 (AECL–5124, pp 209-216) IN-REACTOR TESTS OF COLLECTRONS AND MINIATURE FISSION CHAMBERS. Duchene, J.; Le Meur, R.; Verdant, R. (Services d'Electronique de Saclay, France). Jun 1975. (In French)

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed-fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Many slow collectrons, self-powered neutron detectors with rhodium, silver or vanadium emitters, had been tested by the "Commissariat à l'Energie Atomique" (C.E.A.) Thus 120 vanadium collectrons are correctly operating on the EL 4 heavy water reactor. Also, fast collectrons with cobalt emitters were tested at Saclay by Electronic Services. About 50 cobalt collectrons are still standing in reactors, in 60 or 300°C water. Sensitivity is dependent on emitter diameter, 0.2 and 2×10^{-22} A/n.cm^{-2}s^{-1} per cm for 0.5 and 2 mm, respectively. During irradiation six cobalt collectrons have integrated 3×10^{21} neutrons cm^{-2} and three others 10^{22} neutrons cm^{-2}. Other studies concern 6 mm diameter miniature fission chambers. They were tested in pulsed operation up to 600°C with 10^{19} neutrons cm^{-2}. A slow response chamber was correctly operated up to 600°C. Two fast response chambers filled with argon-nitrogen mixture, became slow during irradiation, but operated up to 600°C. Another chamber of 4.7 mm diameter, filled with argon, for use in pressurized water reactors was studied. (auth)

9314 (BNL-20628) NEW APPROACH TO TIMING: THE FAST–FAST SYSTEM. Hardy, W. H. II; Lynn, K. G. (Brookhaven National Lab., Upton, N.Y. (USA)). 1975. 5p. (CONF-751116-16). Dep. NTIS $4.50.

From nuclear science symposium; San Francisco, California, USA (17 Nov 1975).

A dual channel constant fraction timing discriminator incorporating multiple energy windows and coincidence logic has been developed. Incorporation of energy discrimination and fast coincidence logic into the timing channel has distinct advantages in terms of system simplicity, stability and data rates. A prototype applying the F^2 approach has been constructed and tested. The system gives a ^{60}Co FWHM of approximately 210 psec at a singles rate of greater than 7.5×10^5 sec^{-1} (approximately 1200 coincidences/sec). (auth)

9315 (CONF-751148-1) 249 cm^3 Ge(Li) DETECTOR FOR MEDICAL IMAGING. Kirby, J. A.; Phelps, P. L.; Sawyer, D.; Armantrout, G. A.; Shipley, W. W.; Atkins, F. B.; Charleston, D. B.; Beck, R. N. (Franklin McLean Memorial Research Inst., Chicago, Ill. (USA); California Univ., Livermore (USA). Lawrence Livermore Lab.). 1975. 4p. Dep. NTIS $4.50.

From winter meeting of the American Medical Society; San Francisco, California, USA (16 Nov 1975).

The feasibility of constructing a radioisotope scanner using a Ge(Li) detector with adequate efficiency for clinical use is discussed. (WHK)

9316 (CRN/PN-75-2) PREPARATION AND CHARACTERIZATION OF DIAMOND DETECTORS. Kozlov, S. R.; Stuck, R.; Hage-Ali, M.; Siffert, P. (Centre National de la Recherche Scientifique, 67-Strasbourg (France). Centre de Recherches Nucleaires). 1975. 22p. INIS.

From Nuclear Science Symposium; Washington, D. C., USA (11 Dec 1974).

It is shown that natural diamond can be used as a homogeneous conduction counter with near complete charge collection, even over a long period of time. Indeed, polarization effects have been suppressed by making the back contact of the detector injecting under the influence of the applied field in order to compensate for trapped charge carriers. The electric and detection characteristics of these counters have been investigated. Possible application fields are briefly discussed. (FR)

9317 (CRN/PN-75-11) NUCLEAR RADIATIONS SEMICONDUCTOR DETECTORS: RECENT DEVELOPMENT. Siffert, P.; Ponpon, J. P.; Cornet, A. (Centre National de la Recherche Scientifique, 67-Strasbourg (France). Centre de Recherches Nucleaires). 1975. 77p. (In French). INIS.

The properties of γ nuclear detectors based on high purity germanium (Ge H. P.), cadmium telluride (CdTe) and mercuric iodide (HgI_2) are described. The potential use of these materials is discussed. (FR)

9318 (EUR-5273d-e-f(Vol. 2)) PROCEEDINGS OF SECOND SYMPOSIUM ON NEUTRON DOSIMETRY IN BIOLOGY AND MEDICINE, NEUHERBERG/MUNICH, SEPTEMBER 30–OCTOBER 4, 1974. II. Burger, G.; Ebert, H. G. (eds.). (Commission of the European Communities, Luxembourg). Mar 1975. 462p. (In Several Languages). (CONF-740940-P2). EUR (Vol. I and II) B. Fr. 2,000.

Conference proceedings of 26 papers presented, 16 abstracts appear in NSA, 3 appear in ERA, and 4 appeared previously in NSA as numbers: 32:01037; 32:00803; 31:25859; and 31:22861. (GHT)

For abstracts of individual papers see: 9319, 9350, 9959, 11055–11065, 11083, and 11084.

9319 (EUR-5273d-e-f(Vol. 2), pp 929-937) CALIBRATION OF LARGE-VOLUME NEUTRON DETECTORS WITH ISOTROPIC AND UNIFORMLY DIRECTED INCIDENT THERMAL NEUTRONS. Matzke, M. (Physikalisch-Technische Bundesanstalt, Brunswick). Mar 1975. (In German).

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F. R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

By the example of calibration of a cylindrical dose output measurement instrument (neutron Rem counter), the irradiation devices are described and the measurement methods given which are used in the Physikalisch-Technischen Bundesanstalt in large-volume detectors of thermal neutrons. For quasi-isotropic incidence of the thermal neutrons the detectors were calibrated in a cavity in the graphite core of the flux density standard I. The counting rate of thermal neutrons was determined from the difference of the counting rates of two irradiators with and without Cd shields for the detectors. The flux density of thermal neutrons at various points of the detector surface was determined from the saturation activities of simultaneously irradiated Au foils on the detector surface. For uniformly directly incident thermal neutrons the detectors to be calibrated were calibrated point by point with and without Cd shields with a well bundled beam of neutrons from the beam hole S1 of the FMRB reactor. The counting rate produced in irradiation of the detector in a broad parallel bundle was determined by numerical integration. The measurement results obtained using a Rem counter by both calibration methods were compared with the results of other authors. (tr-auth)

9320 (IN-2P3-CF-74-1, pp 9-18 (Pt. 2C)) MAGNETIC QUADRUPOLE TRIPLET LENS FOR THE PARTICLE BEAM DETECTION AT ZERO DEGREE. Laurent, H.; Schapira, J. P.; Fortier, S.; Gales, S.; Maison, J. M. [nd]. (In French)

From scientific meeting of the Tandem accelerators users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. (Institut National de Physique Nucleaire et de Physique des Particules, 75-Paris (France)).

A new system in which charged particles are detected at 0 deg with respect to the incident beam has been designed. It uses the focusing properties of three magnetic quadrupoles operating in the symmetric mode. It operates with a simple single circular counter of an area of 300 mm^2 and can be used for particle–γ and particle-particle studies according to the Litherland and Ferguson method. (FR)

9321 (LA-UR-75-2232) AMERICAN NATIONAL STANDARD CRITICAL ACCIDENT ALARM SYSTEM. Smith, D. R. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 3p. (CONF-760202-10). Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

An American National Standard has been developed to provide guidance for the design, maintenance, and use of criticality accident alarm systems. Discussion includes several details of this Standard, N16.2-1969, and of a revised version which is now nearing certification. (auth)

9322 (ORNL-TM-5083) POSITION-SENSITIVE PROPORTIONAL COUNTERS USING RESISTANCE-CAPACITANCE POSITION ENCODING. Kopp, M. K.; Borkowski, C. J. (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 72p. Dep. NTIS $6.00.

A new method was developed for encoding the position of individual photons, neutrons, or charged particles in proportional counters by using the distributed RC line characteristics of these counters. The signal processing is described and guidelines for the design and operation of these position sensitive proportional counters (PSPCs) are given. Using these guidelines, several prototypic PSPCs were constructed to improve the spatial resolution and shorten the signal processing time; for example, the intrinsic spatial uncertainty was reduced to 28 mu fwhm for alpha particles and 100 mu fwhm for low-energy x rays (2 to 6 keV). Also, the signal processing time was reduced to 0.6 mu sec without seriously degrading the spatial resolution. These results have opened new fields of application of the RC position encoding method in imaging distributions of photons, charged particles, or neutrons in nuclear medicine, physics, and radiography. (auth)

9323 (UCRL-76937) HIGH-EFFICIENCY MULTIDETECTOR SYSTEM FOR TUMOR SCANNING. Kirby, J. A.; Phelps, P. L.; Armantrout, G. A.; Sawyer, D.; Beck, R. N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Nov 1975. 9p. (CONF-751116-10). Dep. NTIS $4.50.

From nuclear science symposium; San Francisco, California, USA (17 Nov 1975).

A high-efficiency detector system developed especially for medical imaging has three specially cut Ge(Li) coaxial detectors (total volume 249 cm^3). At 122 keV, the peak efficiency is 93 percent of that of a 7.6 x 7.6 cm NaI (Tl) detector. Degradation of the paralleled energy resolution is avoided and resolution is improved by 35 percent over that of conventional output-summing techniques by gating the detector outputs. In effect this multiplexes them to a single line output. (auth)

9324 DIGITAL PROCESSING OF IMAGES FROM A ZONE PLATE CAMERA. Wilson, B. C. (Inst. of Cancer Research, Sutton, Eng.); Parker, R. P.; Dance, D. R. Phys. Med. Biol.; 20: No. 5, 757-770(Sep 1975).

A method for the digital decoding of data obtained with a gamma camera fitted with a zone plate aperture is described. Taking a line source as the object, computer simulations have been used to examine the effects of noise, solid angle variations, shape of detector and detector resolution and methods of dealing with these effects are considered. Using an Anger gamma camera and a zone plate aperture both a line source and a thyroid

phantom containing ^{99m}Tc have been well reconstructed. The behaviour of the system with regard to resolution, signal-to-noise ratio and tomographic capability is discussed. (auth)

9325 NON-LINEAR PROGRAMMING METHOD FOR OPTIMIZING PARALLEL-HOLE COLLIMATOR DESIGN. Simmons, G. H. (Bureau of Radiological Health, Cincinnati); Christenson, J. M.; Kereiakes, J. G. Phys. Med. Biol.; 20: No. 5, 771-788 (Sep 1975).

A new method for optimizing the design of multi-aperture parallel-hole collimators for the γ scintillation camera is presented. The method takes into account the frequency spectrum of a plane source object distribution as well as the energy of the radiation. A frequency dependent statistical figure of merit was calculated and combined with a weighted object distribution frequency spectrum to obtain an objective function which, when maximized, yielded the optimum collimator design according to the chosen criteria. The optimization was performed by means of a sequential pattern search technique. The results showed a positive correlation between the objective function and an experimental performance index evaluated for existing collimators. The optimal designs obtained by maximizing the objective function, under the assumption of no scatter within the source, exhibited somewhat higher sensitivity and lower resolution than the commercial low energy collimators tested. It was concluded that much of the resolution capability of very high resolution collimators is unused because of the limitation imposed by the intrinsic resolution of the detector assembly. (auth)

9326 RADIATION QUALITY AND IMAGE INTENSIFIER CONVERSION FACTOR. Ardran, G. M. (United Kingdom Atomic Energy Authority Research Group, Harwell, Eng.); Crooks, H. E. Br. J. Cancer; 48: No. 572, 678-680(Aug 1975).

ICRU (1963) Handbook 89, states that conversion factors of X-ray image intensifiers should be measured using radiation having an HVL of 7 ± 0.2 mm Al; full wave rectified or constant potential can be used. It is stated that this half value layer would be produced with a total filtration of 22 mm Al and a peak voltage of approximately 85 kV. The authors have obtained an HVL of 7.0 mm Al using a voltage differing from that given by ICRU. It was found that 74 kVp was required while for 8.0 mm HVL 90 kVp was needed. These findings indicate that for examination of the thicker parts of the body, the intensifier will be used most efficiently with respect to exposure and light output at 80 to 90 kVp, provided that for the particular examination this does not significantly reduce contrast. It is suggested that when measuring conversion factors, filtrations of not more than 22 mm Al or 1 to 1.5 mm of copper are adequate to give reliable results. Higher filtrations reduce the output and thereby make the measurements more difficult. (UK)

9327 DETERMINATION OF THE NEUTRON- AND γ-SENSITIVITY OF A Rh-SPN-DETECTOR. Bellmann, D. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany). Inst. fuer Werkstofftechnologie); Hamidian, M. R. (Teheran Univ. (Iran). Nucleare Centre). Atomkernenergie; 26: No. 1, 25-28(1975).

8 figs.; 2 tabs.; 7 refs.

Measurements with a Rh-SPN-detector were carried out to determine the contributions of thermal and epithermal neutrons and gamma radiation to the current signal. The detector was used to measure the neutron flux distribution in a peripherical position of the MTR swimming pool reactor FRG-2 at Geesthacht. The maximum operating power was 15 MW. A method is described in order to measure the thermal neutron sensitivity and the γ-sensitivity of the Rh-SPN-detector. (auth)

9328 SPATIAL RESOLUTION POWER OF THE GAMMA CAMERA SCINTICON. Keil, P. (Siemens A. G., Erlangen (F. R. Germany). Geschaeftsbereich Roentgen). Siemens Forsch.-Entwicklungsber.; 4: No. 3, 152-158(1975). (In German)

5 figs.; 7 refs.

The number of light quanta generated in a crystal and especially the number of electrons produced by these in the photocathodes of the detector system are subject to statistical variations which give rise to a specific distribution of the center points determined electronically per place of absorption. This is a factor of major importance in assessing the inherent resolving power. The principle of the camera is explained theoretically and the improvements achieved relative to the conventional Auger camera are indicated. Additional benefits were derived from a suitable shape of the characteristic curves of the preamplifier accompanied by a reduction of the photomultipliers. (GE)

9329 SCINTILLATION CAMERA WITH A DISK-SHAPED SCINTILLATION CRYSTAL AND A NUMBER OF PHOTOMULTIPLIERS WHOSE OUTLETS ARE CONNECTED TO A POSITION FINDER ACROSS NON-LINEAR AMPLIFIERS. Kulberg, G. H.; Muehlleher, G. (to Searle (G. D.) and Co.). German (FRG) Patent 2,149,279/B/. 23 Jan 1975. 10p. (In German)

10 figs.

A camera with a disk-shaped scintillation crystal is described to which a number of photomultipliers are optically coupled in such a way as to detect light from overlapping faces of the crystal. A non-linear amplifier is assigned to each multiplier to generate coordinate signals corresponding to the point of scintillation in the crystal. Stronger input pulses are amplified more strongly than weaker ones. (GE)

9330 CONVERGING COLLIMATION AND A LARGE-FIELD-OF-VIEW SCINTILLATION CAMERA. Murphy, P. H.; Burdine, J. A.; Moyer, R. A. (Baylor Coll. of Medicine, Houston, TX). J. Nucl. Med.; 16: No. 12, 1152-1157(Dec 1975).

Three low-energy multihole converging collimators were evaluated in reference to accepted imaging parameters using a prototype large-field-of-view scintillation camera. A substantial improvement in resolution and/or sensitivity with depth was observed. Because of the large detector, the inherent reduction in field size due to convergence was not detrimental to satisfactory imaging of most target volumes. Such collimation should prove to be of significant clinical value. (auth)

9331 CLINICAL EFFICACY OF A LARGE-FIELD-OF-VIEW SCINTILLATION CAMERA. Burdine, J. A.; Murphy, P. H. (Baylor Coll. of Medicine, Houston, TX). J. Nucl. Med.; 16: No. 12, 1158-1165(Dec 1975).

In evaluating the clinical application of a prototype large-field-of-view scintillation camera, a significant increase in the quality of static and dynamic images was observed. With parallel-hole collimation, imaging time for large areas was reduced by more than 50 percent and a marked enhancement in resolution and sensitivity of lung images occurred in relation to those obtained with diverging collimation on a conventional camera. Using converging collimation, the prototype camera produced images of brain and other organs with considerably better depth response than comparative studies performed with standard size cameras. These results demonstrate that further clinically relevant improvement in scintillation camera performance is possible. (auth)

9332 ANALYTICAL STUDY OF A HIGH-RESOLUTION POSITRON RING DETECTOR SYSTEM FOR TRANSAXIAL RECONSTRUCTION TOMOGRAPHY. Derenzo, S. E.; Zaklad, H.; Budinger, T. F. (Univ. of California, Berkeley). J. Nucl. Med.; 16: No. 12, 1166-1173(Dec 1975).

This paper presents an analytical study of a high-resolution positron ring detector system for transaxial reconstruction tomography. Our goal is a combination of good spatial resolution, high sensitivity, rejection of scattered photons, variable section thickness, and the minimization of the number of photomultipliers and coincidence circuits. A circular ring of 288 NaI(Tl) crystals 0.8 cm wide should provide a resolution of 4 to 7 mm FWHM over a circular region 30 cm in diameter. Coded light pipes permit readout using only 72 photomultipliers and 12 coincidence circuits. With properly designed shielding and an energy resolution of 30 percent FWHM, a positron activity of 200 mu Ci per axial centimeter in a 20-cm-diam cylinder of tissue should provide approximately 7,000 events/sec from a 2-cm-thick transaxial section (including a 5 percent accidental coincident background and a 26 percent scattered coincident background). This rate is adequate for both static and dynamic imaging. The device can operate at two to three times higher event rates with increased backgrounds. (auth)

9333 PLUTONIUM MONITOR. Goldstein, N. P. (to Westinghouse Electric Corp.). US Patent 3,914,602. 21 Oct 1975. Filed date 14 Nov 1973. 6p.

A coincidence measuring circuit responding to the output signals from first and second scintillation counters adapted respectively to respond to alpha particles and X-rays produced by a monitored environment provides reliable detection of plutonium in the presence of other radioactive elements such as radon and its daughter products. (auth)

9334 GAMMA CAMERA. Stout, K. J. (to Raytheon Co.). US Patent 3,914,611. 21 Oct 1975. Filed date 21 Nov 1973. 10p.

A gamma camera with a plurality of photomultipliers arranged for locating flashes of light produced by a scintillator in response to incident radiation is described. Individual pulse shaping circuits are utilized for forming pulses in accordance with the energy received by each photomultiplier. The pulse signals obtained for each of the photomultipliers are combined to provide X and Y coordinate location signals, such ones of the pulse signals as having predetermined amplitudes being selected for display. (auth)

9335 POSITION-SENSITIVE RADIATION DETECTOR. Borkowski, C. J.; Kopp, M. K. (to Energy Research and Development Administration). Danish Patent 129,882. 30 Oct 1968. Priority

date 3 Nov 1967, United States of America (USA). 12p. (In Danish).

A position-sensitive radiation detector is provided by inserting a very high resistance collector in an otherwise conventional detector. The rise time of any pulse therefrom is thereby position-sensitive, but energy independent. The rise time, and therefore the position, is accurately determined by pulse shaping and timing means. (DE)

9336 SPECTRAL EFFECTS ON THREE-DIMENSIONAL RECONSTRUCTION FROM X RAYS. McDavid, W.D.; Waggener, R.G.; Payne, W.H.; Dennis, M.J. (Radiology Department, The University of Texas Health Science Center, San Antonio, Texas 78284). Med. Phys. 2: No. 6, 321-324 (Nov 1975).

Continuous bremsstrahlung spectra were calculated for 120 kVp for constant and sinusoidal potentials. Fluorescent radiation for the tungsten target was added to the bremsstrahlung, and the spectra were attenuated through various filter materials. A drawing of an object to be scanned was divided into an array of small squares in which the composition was assumed to be constant. Transmission data for 120 rays at each of 120 angles spanning a range of 180° were calculated. Two algorithms for the reconstruction of attenuation coefficients from projection data, an algebraic reconstruction technique (ART) and the convolution method, were utilized to reconstruct effective coefficients. The effect of spectral filtration on the quality of the reconstruction was evaluated. Lightly filtered x-ray beams give rise to severe distortions in image quality, with values of the reconstructed coefficients rising toward the periphery of the object. Highly filtered beams give rise to images with less pronounced distortion. (auth)

9337 LESION DETECTABILITY AS A FUNCTION OF PULSE-HEIGHT SELECTION FOR DYNAMIC IMAGING WITH ^{99m}Tc. Dubuque, G.L.; Kereiakes, J.G. (Radiology Department, University of Cincinnati, Cincinnati, Ohio 45267); Christenson, J. Med. Phys. 2: No. 6, 325-327 (Nov 1975).

Previous studies on pulse-height selection for scintillation cameras have been concerned with static imaging or asymmetric window settings around the photo peak. For count densities typical of those encountered in flow studies and for the customary symmetric window it is shown here, both computationally and experimentally, that a window setting in the range of 25–35% provides the maximum lesion detectability rate for lesions of 0.5- to 2.0-cm diameter. (auth)

9338 DETECTION OF ATOMIC OXYGEN AND ATOMIC HYDROGEN BEAMS BY SEMICONDUCTORS. Jacob, A. (Plasma R & D Laboratory, Process Control Division of LFE Corporation, Waltham, Massachusetts 02154). J. Appl. Phys. 46: No. 12, 5116-5121 (Dec 1975).

Experimental evidence indicated that semiconductors like Si, Ge, CdS, and ZnO prove to be suitable detectors of atomic oxygen and atomic hydrogen fluxes. With suitable operating conditions detection is possible in the presence of the parent molecular gases. The method described herein is specific, highly sensitive, and characterized by simple handling. (auth)

9339 SORPTION-INDUCED CHANGES IN DETECTION EFFICIENCY OF β-EMITTERS IN LIQUID SCINTILLATION SPECTROMETERS. Tykva, R.; Podracka, E. (Inst. of Organic Chemistry and Biochemistry, Prague). Collect. Czech. Chem. Commun.; 40: No. 10, 3123-3129(Oct 1975).

Detailed examinations have been carried out in a liquid scintillation spectrometer on changes in detection efficiency of β-nuclides due to sorption of labelled substances to the inner surface of the vial. It has been shown that the influence of sorption on the counting conditions may assert itself already in the course of several hours after preparation of the sample. The difference between sorption effects in the case of a high-energy (^{32}P) and a low-energy (^{45}Ca) β-nuclide has been discussed on the basis of amplitude spectra. The stability of the sorption of labelled substances to the vial surface has been examined and various routes for removing its influence on changes in detection efficiency have been studied. (auth)

9340 A PROPOSED X-RAY FOCUSING DEVICE WITH WIDE FIELD OF VIEW FOR USE IN X-RAY ASTRONOMY. Schmidt, W. K. H. (Max-Planck-Institut fuer Physik und Astrophysik, Garching; Muenchen (F. R. Germany). Inst. fuer Extraterrestrische Physik). Nucl. Instrum. Methods; 127: No. 2, 285-292(1 Aug 1975).

A device is described that consists of a set of flat reflecting surfaces. At glancing incidence of X-rays of wavelength several A and longer, this device can be used for the focusing of a sizeable portion of an intercepted beam of X-rays incident in parallel. Focusing is not perfect and the image size is finite. But a one-dimensional focusing device offers a wide field of view, up to a maximum of 2π. It appears practically possible to achieve an angular resolution of the order of one tenth of a degree. Two such systems in sequence so as to form a double-focusing device, should offer a field of view of up to 100 square degrees at moderate angular resolution. It is proposed to use such devices in X-ray astronomy survey or monitor experiments. (NL)

9341 THE RESPONSE OF SCINTILLATION COUNTERS TO INTERNALLY INDUCED RADIOACTIVITY. Seltzer, S. M. (National Bureau of Standards, Washington, D. C. (USA)). Nucl. Instrum. Methods; 127: No. 2, 293-304(1 Aug 1975).

Pulse height distribution produced in NaI and CsI detectors by the decay of certain internally distributed radionuclides have been calculated using a Monte Carlo method. The method traces the possible decays of a radioactive atom, taking into account $\beta\pm$ emission, electron capture, gamma ray emission, internal-conversion-electron emission, and X-ray or Auger-electron emission following the creation of atomic K-shell vacancies. The scattering, absorption and escape of gamma-rays, annihilation quanta and X-rays are included. Results are presented for the radioisotopes ^{22}Na, ^{124}I, ^{124}Sb, ^{125}Sb, ^{123m}Te, and ^{125m}Te to indicate the characteristic features of the pulse-height distributions. (NL)

9342 A NOISE ANALYSIS IN GOLD-N SILICON SURFACE BARRIER RADIATION DETECTORS. Fleming, J. S. (Wessex Regional Department of Nuclear Medicine, Southampton General Hospital, Southampton, England); Nightingale, J. M. (Southampton Univ. (UK)). Nucl. Instrum. Methods; 127: No. 2, 221-224(1 Aug 1975).

An analysis of noise in silicon surface barrier detectors has been made in order to determine the contributions from the different noise sources to the total noise of the detector amplifier combination. A summary of the noise theory is described and a comparison of predicted noise and practically measured values presented to test the validity of the theory. (NL)

9343 THE RESOLUTION OF A POSITION-SENSITIVE SCINTILLATION DETECTOR FOR NEUTRONS. Grosshoeg, G. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Institutionen foer Reaktorfysik). Nucl. Instrum. Methods; 127: No. 2, 183-188(1 Aug 1975).

The space distribution of neutron interactions in a lithium-glass scintillator is measured by means of a method which uses the relative pulse amplitudes from two photomultipliers as position indicators. Digital linearization and background discrimination are done during the storage process in an on-line computer. The system gives a resolution of $(5.4 \pm 0.4)\%$. (NL)

9344 PULSE-FORMATION DELAY TIMES IN GAS PROPORTIONAL DETECTORS. Ritchie, A. I. M.; Rose, A. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Nucl. Instrum. Methods; 127: No. 2, 237-241 (1 Aug 1975).

The delay times between neutron-induced proton events and the associated pulse of electrons in a gas-filled proportional counter have been measured as a function of pulse height for different gas pressures and primary neutron energies. Qualitative explanations are advanced for the marked correlations observed between delay time and pulse height, and to explain why the measured delay times are much longer than those expected from the simple theory of electron drift times. (NL)

9345 CONSTRUCTION OF HIGH-TEMPERATURE PULSE-TYPE FISSION CHAMBER (TYPE GML-20). Ch'ing Hua Ta Hsueh Hsueh Pao; No. 3, 49-60(Sep 1973). (In Chinese)

This paper describes a new process of constructing high temperature operation pulse-type fission chambers. This chamber can be operated at a temperature up to 650°C. Its sensitivity is about 0.1 c/sec/n/cm^2 · sec. The plateau length is 250 volts at 650°C, but 800 volts at room temperature. It is possible to count at 1×10^5 c/sec with less than 10 percent counting losses. Under about 400 hours long-term high temperature (650°C) tests, this chamber shows no sign of deterioration. The fission chamber construction, material, manufacturing techniques and the rigid extension are described, and the characteristics of the chamber at 650°C are also given. Some problems arising in high temperature tests are discussed. (auth)

9346 CAMERA DEADTIME: RATE-LIMITING FACTOR IN QUANTITATIVE DYNAMIC STUDIES. Ben-Porath, M. (Technion-Israel Inst. of Tech., Haifa). Int. J. Nucl. Med. Biol.; 2: No. 3, 107-112(Jul 1975).

Camera deadtime presents a major problem in the quantitation of dynamic studies. Appropriate correction factors should be applied before quantitation is attempted. Tables, graphs and equations are presented for the demonstration of the effect and calculation of the errors introduced by systems of various deadtime. (auth)

9347 ELECTRON MULTIPLIER-ION DETECTOR SYSTEM. Dietz, L. A. (to U. S. Energy Research and Development Administration). US Patent 3,898,456. B01D59/44; G01T1/20; H01J39/34. 5 Aug 1975. Filed Date 25 Jul 1974. 4p.

PAT-APPL-491,988.

This patent relates to an improved ion detector for use in mass spectrometers for pulse counting signal ions which may have a positive or a negative charge. The invention combines a novel electron multiplier with a scintillator type of ion detector. It is a high vacuum, high voltage device intended for use in ion microprobe mass spectrometers. (auth)

Radiation Dosimeters

Refer also to abstracts 8902, 9111, 9493, 9509, 9597, and 9600.

9348 (AEEW-R-1018) SOME NOTES AND COMMENTS ON THE HARSHAW 2271 AUTOMATIC TLD SYSTEM FOR PERSONNEL DOSIMETRY. Preston, H. E.; Gill, D. W. (UKAEA Reactor Group, Winfrith, Atomic Energy Establishment). 1975. 17p. Dep. NTIS $4.25.

If the standard UKAEA/RPS film is to be replaced by a different type of dosimeter, it seems obvious at the present time that this replacement will be some form of thermoluminescent device. A commercially available dosimeter and automatic reader is produced by the Harshaw Chemical Company, employing LiF/T.L.D. ribbons. Experience over a period of four weeks with this system is described, with comments on its application to personnel dosimetry. (auth)

9349 (CONF-760202-7) EXPERIENCES IN ENVIRONMENTAL MONITORING WITH BeO CERAMIC DOSIMETERS. Gammage, R. B.; Haywood, F. F. (Oak Ridge National Lab., Tenn. (USA)). 1975. 7p. Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

Ceramic BeO disks used as radiation detectors have been evaluated in environmental radiation fields by observing the TL and TSEE signals given off after heating the disks. Fluxes of low energy photons cause the values for the two apparent exposure rates to diverge; this provides a measure of the quality of the photon radiation field. The mean of the TL and TSEE derived exposure rates is close to the exposure rate as determined by other means. The TL-TSEE dosimeters perform satisfactorily provided moisture is not allowed to condense onto the BeO and wet its surface when the temperature falls below the dew point. Thin impervious plastic packets or aluminium cans, containing silica gel desiccant, provide adequate protection. (auth)

9350 (EUR-5273d-e-f(Vol.2), pp 879-894) EXPERIMENTAL DETERMINATION OF THE NEUTRON SENSITIVITY FUNCTION OF A DOSIMETER. Kuchnir, F. T.; Vyborny, C. J.; Skaggs, L. S. (Univ. of Chicago). Mar 1975.

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F.R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

The bombardment of a thick beryllium target by charged particles produces a neutron field which varies with angle and a gamma component which is isotropic. Differences in detector response at two positions in these fields are due to neutrons alone. Such differences were used along with neutron energy distributions measured by time-of-flight techniques to iteratively unfold the neutron response of a Mg-Ar ionization chamber as a function of neutron energy. (auth)

9351 (UCRL-77198) EFFECT OF ENERGY DEPENDENCE ON THE EVALUATIONS OF ALBEDO NEUTRON DOSIMETERS. Hankins, D. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Nov 1975. Contract W-7405-Eng-48. 9p. (CONF-760202-21). Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

Albedo neutron dosimeters have proven to be effective as a method of measuring the dose from low-energy neutrons that other types of personnel neutron dosimeters do not detect. Many albedo neutron dosimeters have been designed, and some are being used extensively. All albedo neutron dosimeters are energy-dependent, becoming less sensitive as the energy of the neutrons is increased. In this paper the energy dependence and the effect it has on the evaluation of the dose are discussed. Numerous measurements are shown which were made under field conditions at five reactors, two accelerators, a radiochemistry facility, two plutonium facilities, a low-scatter neutron irradiation facility, three storage vaults, and at the N.B.S. low-energy neutron beams. These measurements show the limits imposed by the energy dependence on the evaluation of the dose determined by albedo neutron dosimeters. In most cases evaluation of an individual's dose occurring in a single facility can be reasonably accurate, but it must be known in which facility the person was exposed. Procedures using the incident thermal neutron response of TLDs located on top of the dosimeter to correct for the energy dependence are discussed; and errors caused by wearing a dosimeter improperly are evaluated. (auth)

9352 (UCRL-77532) COMPARISON OF GAMMA-RAY EXPOSURE RATE MEASUREMENTS AT BIKINI ATOLL. Gudiksen, P. H.; Crites, T. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Nov 1975. Contract W-7405-Eng-48. 4p. (CONF-760202-18). Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

A radiological survey of Bikini and Eneu Islands of the Bikini Atoll was conducted during June 1975 to assess the potential radiation doses that may be received by the returning Bikinians. Bikini Atoll was one of the U.S. nuclear weapons testing sites in the Pacific. An integral part of the survey included measurements of the gamma-ray exposure rates at 1 m above the ground with portable NaI instruments at nearly 2700 locations on the two islands. For comparison purposes, similar measurements were made with a pressurized ion chamber at approximately 200 locations, and with LiF and CaF_2:Dy thermoluminescent dosimeters (TLDs) at 80 locations. The results indicate that the NaI scintillators overresponded because of their nonlinear energy characteristics. The responses of the LiF dosimeters and the pressurized ion chamber agreed to within 13 percent. Attenuation studies with LiF TLDs indicated that roughly 25 percent of the total free air exposure rate at 1 m was due to beta radiation. (auth)

9353 MULTIPURPOSE PERSONNEL DOSIMETRY HOLDER. Moos, W. S. (Eidgenoessisches Gesundheitsamt, Bern (Switzerland). Sektion fuer Strahlenschutz). Kerntechnik; 17: No. 6, 287(Jun 1975).

3 figs.; 1 tab.

The new holder design allows for the use of film or TL dosimeter elements. Four different filter area arrangements can be sequentially evaluated with both types of dosimeters. Three different means of attachment of the holders are provided. Effects of radiation energy are quite comparative with other existing holders. (auth)

9354 POTENTIOMETRIC EVALUATION OF FRICKE-DOSIMETER MEASUREMENTS. Bridi, A.; Buchtela, K. (Atominstitut der Oesterreichischen Hochschulen, Vienna). Atomkernenergie; 25: No. 4, 249-250(1975). (In German)

3 figs.; 20 refs.

The determination of Fe(III) in Fricke-dosimeters can be performed by potentiometric measurements. Results of measurements after γ-irradiation and after irradiation in a reactor are mentioned. With this simple technique it is possible to make dosimetric measurements even during the irradiation. (auth)

9355 STEM CORRECTIONS FOR IONIZATION CHAMBERS. Ibbott, G.S.; Barnes, J.E.; Hall, G.R.; Hendee, W.R. (University of Colorado Medical Center, Denver, Colorado 80220). Med Phys. 2: No. 6, 328-330 (Nov 1975).

Ionization chambers often exhibit a stem effect, caused by interactions of radiation with air near the chamber end, or with dielectric in the chamber stem or cable. These interactions contribute to the apparent measured exposure. To determine the stem effect for several common ionization chamber systems, exposures were measured with TLD capsules placed at the center of ^{60}Co fields of various sizes. These exposure measurements then were repeated with various ionization chamber systems, including two Victoreen R meters (25- and 100-R chambers), a Capintec 192 dosimeter with a Farmer 0.6-cm^3 probe, a PTW transit dose probe, and an EG&G IC-18 probe with a Keithley 610-B electrometer. From a comparison of TLD and ionization chamber measurements of the variation in exposure rate with field size, stem corrections for the different systems were determined within 1%. (auth)

9356 MEASURING TRITIUM WITH EXOELECTRON DOSIMETERS. Gammage, R. B.; Cheka, J. S. (Oak Ridge National Lab., Tenn. (USA)). Nucl. Instrum. Methods; 127: No. 2, 279-284(1 Aug 1975).

Small disks of ceramic BeO, called Thermalox 995, are sensitive detectors of tritium when read for thermally stimulated exoelectron emission (TSEE). An additional reading of the thermoluminescence provides a means for estimating the exposure to tritium in the presence of other penetrating radiations. Weakly contaminated surfaces less than 1 nCi/cm^2, which are small, curved, or difficult to reach, can be monitored accurately. While the detector sensitivity is sufficient to measure tritium gas or tritiated water vapor at allowable, occupational exposure levels, the sensitivity of this particular detector is insufficient for monitoring members of the public exposed continuously to HTO vapor at the MPC. The TSEE peak location and shape are useful features for identifying an exposure to tritium. Prior to reading, rinsing the detector in alcohol is desirable to prevent spurious electron emissions. (NL)

9357 DOSIMETER DESIGN, CONSTRUCTION, AND IMPLANTATION. Winter, D. L.; Suri, K.; D'Urso, J. A.; Cota, F. L.; Ashley, W. W.; Binnard, R. M.; Haymaker, W.; Benton, E. V.; Cruty, M. R.; Zeman, W. (Univ. of California, San Francisco). Aviat., Space Environ. Med.; 46: 494-499(Apr 1975).

To detect the passage of cosmic ray particles through the heads of the pocket mice during the Apollo XVII flight, a "monitor" (dosimeter) composed of plastics was prepared and implanted under the scalp. The monitor was mounted on a platform, the undersurface of which fitted the contour of the skull. Numerous tests were run to assure that the presence of the monitor assembly beneath the scalp would be compatible with the well-being of the mice and that the capacity of the monitor to detect the traversal of cosmic ray particles would be preserved over the several weeks during which it would remain under the scalp. (auth)

9358 FAST-NEUTRON SOLID-STATE DOSIMETER. Kecker, K. H.; Haywood, F. F.; Perdue, P. T.; Thorngate, J. H. (to U. S. Energy Research and Development Administration). US Patent 3,896,306. H05B33/00; G01T3/00. 22 Jul 1975. Filed Date 20 Jun 1974. 4p.

PAT-APPL-481,262.

This patent relates to an improved fast-neutron solid-state dosimeter that does not require separation of materials before it can be read out, that utilizes materials that do not melt or otherwise degrade at about 300°C readout temperature, that provides a more efficient dosimeter, and that can be reused. The dosimeters are fabricated by intimately mixing a TL material, such as $CaSO_4$:Dy, with a powdered polyphenyl, such as p-sexiphenyl, and hot-pressing the mixture to form pellets, followed by out-gassing in a vacuum furnace at 150°C prior to first use dosimeters. (auth)

9359 CALIBRATING CHEMICAL DOSIMETERS OF PHOTON RADIATION BY MEANS OF A CALORIMETER FOR HEAT FLUX. Berlyand, V. A.; Generalova, V. V.; Gurskii, M. N. (All-Union Scientific Research Inst. for Physical-Technical and Radiotechnical Measurements, Moscow). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 6, 66-68(1974). (In Russian).

A calorimeter is described in which the absorber is water contained in a polystyrol cylinder having a wall thickness of 0.2 mm. In calibrating the calorimeter in units of absorbed dose a heating spiral is lowered into the water. A thermal battery registers the thermal flux between the absorber of the calorimeter and the body of the thermostat. A thermal shield and the thermostat decrease the effect of temperature oscillations in the surrounding medium. The error of measuring the adsorbed dose did not exceed ±2% at a 95% confidence level. These results were used to calibrate ferrous sulfate and glucose dosimeters. A value of 15.6 ± 0.6 moles/100 eV was found for the G value of Fe^{3+} production in a ferrous sulfate dosimeter. This value is in good agreement with literature data. (SJR)

9360 HIGH-RADIATION-DOSE DOSIMETRY SYSTEMS. Lambert, K. P.; Schonbacher, H.; Van de Voorde, M. (Organisation Europeenne de Recherches Nucleaires, Prevessin, France). pp 153-160 of Evaluation of the Effect of the Space Environment on Materials. Paris; Centre National d'Etudes Spatiales (1974).

From conference on evaluation of the effect of the space environment on materials; Toulouse, France (17 Jun 1974).

Data concerning the principal Megarad dosimeters have been analyzed in a search for the most suitable dosimeter for material damage studies in a high-energy particle accelerator environment. This has resulted in the adoption of the phosphate glass radio-photoluminescent (RPL) system for routine dosimetry. (auth)

Nuclear Spectroscopic Instrumentation

Refer also to abstracts 11085 and 11242.

9361 (CEA-N-1806) DEVICE FOR THE MEASUREMENT OF NEUTRON RADIATIVE CAPTURE. Alix, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique Nucleaire; Bordeaux-1 Univ., 33 (France)). May 1975. 118p. (In French). INIS.

Neutron capture cross sections are one of the most important parameters in nuclear reactor calculations. Some facilities built to measure these cross sections by using the time of flight method with the 60 MeV Linac of Saclay as a pulsed neutron source are described. A gamma ray detector based on the Maier-Leibnitz principle was chosen. That detector is divided into two optically decoupled cells. Each one contains the NE 226 liquid scintillator. That detector is connected to an electronic system which effects on line the weight correction to render the detector sensitivity proportional to the gamma ray energy. That new system is equipped with a wired program. It is much less expensive and faster than a computer used for the same purpose. (FR)

9362 (CRN/PN-74-9) CHARACTERIZATION OF SEMICONDUCTOR MATERIALS BY LIFETIME MEASUREMENTS FOR USE IN NUCLEAR SPECTROMETRY. Berger, R. (Centre National de la Recherche Scientifique, 67-Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1974. 91p. (In French). INIS.

To overcome the problem of charge carrier trapping in semiconductor nuclear radiation detectors the possibility to characterize the starting material by charge carrier lifetime measurements performed at low temperature has been investigated in order to select the crystals suitable for γ-ray detectors. This work is divided into four sections dealing first with the concept of charge carrier lifetime tau in semiconductors, then with the different experimental techniques which have been developed to determine tau. Then these methods are applied to silicon, germanium P, and HP (high purity) cadmium telluride. Finally, it is shown that a theoretical and experimental correlation exists between the performance of Ge(Li) spectrometers and the charge carrier lifetime as measured in the raw material at 77°K. (FR)

9363 (JINR-P13-9028) HIGH VOLTAGE CONTROL OF PHOTOMULTIPLIERS. Kollar, D.; Kollarova, L.; Horvath, P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 8p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

Digitally controlled CAMAC module for automatic measurement of EHT characteristic of photomultipliers and for stability of gain control of the spectrometric channels with photomultipliers is described. (auth)

9364 (UCRL-77498) 1024-CHANNEL PORTABLE GAMMA-RAY SPECTROMETER. McGibbon, A. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Nov 1975. Contract W-7405-Eng-48. 11p. (CONF-751210-1). Dep. NTIS $4.50.

From proceeding of the measurement science; San Luis Obispo, California, USA (5 Dec 1975).

An instrument is described which is designed to determine radioactive isotope spectra in the field under adverse environmental conditions. The instrument is battery-powered, stores and compares multiple spectra, and performs computations upon the resulting displayed graph. (auth)

9365 VELOCITY ANALYZER FOR HIGH ENERGY ELECTRONS. Kamiya, Y.; Suzuki, T. (Nagoya Univ. (Japan). Dept. of Physics); Shimizu, K. (Osaka Univ., Suita (Japan). Inst. of Scientific and Industrial Research). Optik; 41: No. 4, 421-435 (Dec 1974).

10 figs.; 2 tabs.; 11 refs.

The electron optical properties of the cylindrical lens are investigated experimentally and theoretically in the voltage range 400 kV and 1,000 kV. It is shown that the cylindrical lens gives an energy spectrum with sufficient resolution for high energy electrons. Since the theoretical calculation is based on the bell shaped distribution of the magnetic field, the agreement between theory and experiment is not very good. The theoretical estimation, however, is useful to design the analyzer. (auth)

9366 ENERGY CALIBRATION AND LINEARITY IN THE ENERGY RANGE 13 keV TO 1 MeV WITH THE SPECTROMETRY OF β-, γ-, AND K-EMITTERS IN LIQUID SCINTILLATORS UP TO A DETECTOR VOLUME OF 310 ml. Taegder, K.; Schmitz-Feuerhake, I. (Medizinische Hochschule Hannover (F. R. Germany). Inst. fuer Nuklearmedizin und Spezielle Biophysik). Atomkernenergie; 25: No. 3, 207-213(1975). (In German)

8 figs.; 5 tabs.; 12 refs.

A liquid scintillation spectrometer developed for the spectrometry of β, γ- and EC γ-emitters is described. The sensitive detector volume which was mainly used varied from 130 to 310 ml. The energy calibration was carried out with conversion electrons, weak X-rays, and external γ-emitters. The method using external γ-emitters is known as Compton half-value method. This calibration technique is advantageous to routine calibration. The energy range of calibration extends from 13.4 keV to about 1 MeV. In the whole energy range the measurements yielded a linear pulse height-energy relationship. The energy resolution of some conversion electron peaks and Compton edges are tabulated. The investigators found a symmetrical distribution of the measured pulse heights up to a detector volume of 310 ml. Finally the accuracy of the energy calibration was tested with the β-emitters Ca 45 and Cl 36. (auth)

9367 FAST NEUTRON SPECTROSCOPY BETWEEN 20 keV AND 16 MeV BY PROTON RECOIL COUNTERS. Schneider-Kuehnle, P.; Broecker, B.; Clausen, K.; Weinert, M. (Institut fuer Naturwissenschaftlich-Technische Trendanalysen (INT),

Stohl (F. R. Germany)). Atomkernenergie; 26: No. 1, 29-33(1975). (In German)

8 figs.; 9 refs.

To measure the radiation transport originating from a 14 MeV neutron source in air a neutron spectrometer system is described, measuring omnidirectional the neutron energy spectrum between 20 keV and 16 MeV with a resolution of 10% and a total error of max. 15%. To cover this energy range of NE 213 scintillator with n-γ discrimination and 4 spherical proton recoil proportional counters filled with gas are presented. The method and the evaluation procedure are described and some problems with regard to the accuracy of the method are discussed. (auth)

9368 KINETIC STUDIES BY STOPPED-FLOW PULSE FOURIER TRANSFORM NUCLEAR MAGNETIC RESONANCE. Couch, D. A.; Howarth, O. W.; Moore, P. (Warwick Univ., Coventry, Eng.). J. Phys., E (London); 8: No. 10, 831-833 (Oct 1975).

An attachment for a commercial pulse Fourier transform nuclear magnetic resonance spectrometer is described, which enables two solutions to be rapidly and efficiently mixed inside a spinning 5 mm diameter NMR tube. Complete high resolution ^1H NMR spectra can be obtained within 0.2 s of mixing, and at a repetition rate of ca. 0.6 s per spectrum in favorable cases. (auth)

9369 COUNTER TELESCOPE FOR STUDYING 14 MeV NEUTRON-INDUCED REACTIONS. Perng, C. C.; Lin, S. Y.; Hsu, Y. C.; Hsu, Y. C. (National Taiwan Univ., Taipei). Chin. J. Phys. (Taiwan); 13: No. 1, 26-33(Apr 1975).

A counter telescope is constructed for measuring energy and angular distributions of charged particles in the reactions induced by 14-MeV neutrons. Detailed descriptions and main characteristics of the telescope, which consists of two gas proportional counters and a silicon surface barrier detector, are given. The energy spectra from the $^{40}Ca(n,\alpha)^{37}Ar$ and $^{32}S(n,d)^{31}P$ reactions are also presented. (8 figures) (auth)

9370 INTERLABORATORY COMPARISON OF GAMMA COUNTING FACILITIES. Hajek, B. K.; van Diemen, P. (Ohio State Univ., Columbus). pp 84-85 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).

From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

9371 A METHOD OF COMPUTER ANALYSIS OF A NaI(Tl) γ-RAY SPECTRUM. Sekine, T.; Baba, H. (Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken, Japan). Nucl. Instrum. Methods; 127: No. 2, 261-263(1 Aug 1975).

A computer-analysis method of the NaI(Tl) γ-ray spectrum was proposed based on the photopeak method in terms of an analytical expression of the response for a γ-ray. (NL)

9372 γγ COINCIDENCE SPECTROMETRY OF HIGH-ENERGY NUCLEAR REACTION TARGETS. Scheidemann, Oe.; Porile, N. T. (Purdue Univ., Lafayette, Ind. (USA). Dept. of Chemistry). Nucl. Instrum. Methods; 127: No. 2, 189-192 (1 Aug 1975).

The application of Ge(Li) γ-γ coincidence spectrometry to the assay of a uranium foil irradiated by 300 GeV protons is described. Digital gates were set on γ-rays from a number of possible reaction products and coincidence spectra were recorded. The technique was applied to the determination of both cross sections and thick-target recoil properties, and results are presented and compared with those obtained by conventional techniques. (NL)

High Energy Physics Instrumentation

9373 (CEA-N-1800) PROGRAMMING SYSTEM FOR BUBBLE CHAMBER PHOTOGRAPHS MEASURING TABLES ON-LINE TO A COMPUTER. Miche, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Jun 1975. 263p. (In French). INIS.

A programming system available on an industrial computer, type P DP 15/20, performing the exploitation of bubble chamber pictures with the projection tables on line to the computer was developed. This system must suit the particular conditions met in the analysis of photographs from different bubble chambers, the different stage for dealing with the views (scanning, premeasurement, measurement) adapting to different strategies in the handling of measurements. The exploitation of photographs takes place in a conversational mode to which a concrete form is given by sending messages to the operators at the tables and by receiving coded answers. In this framework, the aims of the operating system are: to guide the operator work at the tables while allowing them to interrupt the normal sequence of events, to carry out some elementary logical checks, to write on magnetic tape the checked data with the appropriate labels as required. (FR)

9374 (KFK-EXT-3/75-5) LARGE NEUTRON MISSING MASS SPECTROMETER USING LONG PLASTIC SCINTILLATORS WITH ELECTRONICAL DETERMINATION OF THE NEUTRON INTERACTION POINT. Apel, W. D.; Mueller, H.; Schinzel, D.; Sigurdsson, G.; Staudenmaier, H. M.; Stier, U. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Nov 1975. 36p. Dep. NTIS (US Sales Only) $4.00.

A large acceptance and high efficiency neutron detector is described. The sensitive area and volume of the detector is 3.07 m^2 and 1.03 m^3 respectively. The detector consists of sixteen elements of plastic scintillator, each having the dimensions ($16 \times 16 \times 240$) cm^3. The mean detection efficiency is about 33% for neutrons of 100 to 500 MeV/c momentum. An interesting feature of this instrument is the accuracy achieved in locating incident particles, which is ±3 cm for charged particles and ±4 cm for neutrons. The accuracy achieved for the time-of-flight measurement is ±1 nsec for fast neutrons. (auth)

9375 (KFKI-75-54) COMPUTER CONTROL OF BIS SPECTROMETER. Manno, I. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1975. 16p. Dep. NTIS (US Sales Only) $4.25.

The BIS spectrometer consists of magnets, spark chambers, proportional chambers, scintillation counters, μ detectors and electron detectors and is located at the 76 GeV proton synchrotron at Serpukhov. The computer control system for the spectrometer is described. (WHK)

9376 (LPCTI-74-02) STUDY OF A BUBBLE CHAMBER'S PICTURES AUTOMATIC ANALYZER: COCCINELLE. Jaeger, J. J. (College de France, 75-Paris. Lab. de Physique Atomique de Moleculaire; Paris-7 Univ., 75 (France)). 1974. 271p. (In French). INIS.

Thesis.

The automatic scanning and measuring system "Cocinnelle" built in the Laboratoire de Physique Corpusculaire of College de France, is specially made for the pictures of the new large bubble chambers like BEBC and Mirabelle. This device uses the spot of a high precision cathode ray tube for the analysis of the picture according to a scanning window. The signal of a photomultiplier located behind the picture gives, after processing, the useful information in the form of coordinates of the analyzed points. Electronics, connected to a computer, generates the movements of the films, and gives the right information for the programs of geometrical reconstruction of the tracks. The use of the device is based upon the collaboration of a programmed automation and a human operator that have conversational facilities: TV display, light-pen and function keyboard. Beyond a detailed description of the whole device, this thesis insists especially on the following electronic parts: sweep generation of the spot, photomultiplier signal processing. (FR)

9377 PRACTICAL THEORY OF THE MULTILAYERED TRANSITION RADIATION DETECTOR. Artru, X. (CERN, Geneva, Switzerland); Yodh, G.B.; Mennessier, G. Phys. Rev. D 12: No. 5, 1289-1306 (1 Sept 1975).

The transition radiation detector for ultrarelativistic particles with a multifoil radiator is studied in the following aspects: x-ray spectrum, γ dependence, interference effects, saturation at high γ, effects of irregularities, and multiple scattering. The analysis is simplified by reducing the various parameters to essentially three dimensionless quantities: a scaled Lorentz factor Γ, a scaled frequency ν, and the ratio τ= foil spacing/foil thickness. Large threshold effects due to interference are predicted which can be used to build a threshold detector or to measure the x-ray index of refraction of a material. Theoretical curves are given. Photon statistics, optimization of the detector, and computational method are discussed briefly. (auth)

Radiometric Instruments

9378 SELECTION OF ELECTRON-ENERGY DISCRIMINATION TECHNIQUE IN SPECTROMETRIC ELECTRON-BEAM FLAW DETECTION. Kononov, B. A.; Lisin, V. A. (Electronic Flaw Detection Research Inst., Tomsk, USSR). Sov. J. Nondestr. Test. (Engl. Transl.); 11: No. 1, 115-117(1975).

Translated from Defektoskopiya; 11: No. 1, 131-133(1975).

Equations are derived for the relation between the output signal and the change in mass thickness. Determination of the electron

energy using a magnetic spectrometer on a Cherenkov detector is considered. It is concluded that the Cherenkov detector is move sensitive than the magnetic spectrometer only if the spectrometer passes the particle flux over a narrow energy range near the most probable energy. (DLC)

9379 DATA STORAGE UNIT FOR AN X-RAY FLAW DETECTOR WITH OSCILLOSCOPE DISPLAY. Abramov, V. G.; Gorbunov, V. I.; Epifantsev, B. N.; Korbakov, V. M. (Electronic Flaw Detection Research Inst., Tomsk, USSR). Sov. J. Nondestr. Test. (Engl. Transl.); 11: No. 1, 118-119(1975).

Translated from Defektoskopiya; 11: No. 1, 133-135(1975).

A data storage unit for an x-ray videcon was designed with facilities for subsequent output to a digital computer. The storage device is an LN-19 double-beam storage tube. Its operation is described and an example given of its application. (DLC)

9380 MEASURING COATING THICKNESS BY THE BETA-BACKSCATTER TECHNIQUE. Latter, T. D. T. (Fischer Instrumentation Ltd., Newbury, Eng.). Br. J. Non-Destr. Test.; 17: No. 5, 145-152(Sep 1975).

From measuring the thickness of coatings on metals non-destructively; Derby, Eng. (30 Apr 1975).

The capabilities of the β-ray backscatter technique for measuring coatings of various materials on different substrates are described. Practical instrumentation is explained including continuous and contactless measurement systems. (auth)

9381 INVESTIGATION OF THE NON-DESTRUCTIVE DETERMINATION OF WOOD MOISTURE CONTENT BY NEUTRON-CAPTURE GAMMA RADIATION. Chang, B. Y. Baton Rouge, LA; Louisiana State Univ. (1975). 182p. University Microfilms Order No. 75-21,307.

Thesis (Ph. D.).

A rapid, non-destructive method for determination of wood moisture content could be of major technological and economic benefit to the wood industry. Currently employed methods, however, suffer from thickness, density, limited-range, or other restrictions. Previous investigation of nuclear techniques have revealed similar deficiencies. Theoretically, however, measurement of the thermal-neutron capture-gamma radiations from hydrogen and carbon in a wood specimen leads to a linear equation for moisture content that is free of volume, density, and moisture-range effects. A direct experimental test of this original hypothesis was not possible because of budgetary limitation, and an alternative experimental arrangement was selected to obtain design data for a later direct test. The alternative arrangement, established from preliminary studies, involved a 2.8 microgram californium-252 source centrally placed in a rectangular volume assembled from individual wood blocks, which was viewed with a NaI(Tl) detector coupled with a 400-channel pulse-height analyzer, with direct source gammas shielded by 4 inches of lead. Arrangement of the blocks allows for changing the wood volume without changing the source-detector distance. Net peak areas for the 2.23-MeV capture-gamma from hydrogen and the 4.44-MeV inelastic-scatter gamma from carbon provided the analytical signals. Moisture contents were varied from 0 percent to near saturated condition. The specimens were measured with a 3 x 3-inch detector for 4-minute live-time counts. In addition, limited comparison measurements with a 4 x 4-inch detector were made, as were long-count (greater than 3 hours) measurements to improve counting statistics for the carbon gamma. Results are presented. (WHK)

9382 INFLUENCE OF INSTRUMENT DESIGN OF NEUTRON LIFETIME MEASUREMENTS. Youmans, A. H.; Hopkinson, E. C. (Dresser Atlas, Houston, TX). Soc. Pet. Eng. J.; 15: No. 2, vp (Apr 1975).

Commercially available logging services provide a measurement of the lifetime of thermal neutrons in formations adjacent to a borehole. This lifetime provides a measure of the macroscopic thermal neutron-capture cross-section SIGMA of the formation, which in turn is functionally related to the abundance and constituency of the rock matrix and contained fluids. Because the measurement is extremely sensitive to an abundance of trace elements like boron and gadolinium, it is very difficult to find rock formations with an accurately known value of SIGMA, which is required for the accuracy of the measuring system to be experimentally tested. Various theoretical studies published suggest that errors in the determination of SIGMA may occur because of the influence of borehole parameters and the effects of neutron diffusion. Experimental results are reported that demonstrate that the design of the instrument is crucial to the validity of any theoretical treatment of the subject. The influence of neutron diffusion and borehole effects can be overcome by optimal selection of spacing and shielding parameters. (auth)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

Refer also to abstract 9098.

9383 (AD-672812) EFFECTS OF RADIATION ON SEMICONDUCTOR MATERIALS AND DEVICES. Final Report, 1 January 1967-31 December 1967. Wilson, D. K.; Mitchell, J. P.; Cuthbert, J. D.; Lee, H. S. (Western Electric Co., Inc., New York (USA)). 30 Apr 1968. Contract F19628-67-C-0147. 190p. NTIS $6.00.

Results of investigation on the effects of nuclear radiation on semiconductor materials, device surface layers, and devices are discussed. (auth)

9384 (AD-696680) RADIATION EFFECTS RESEARCH PROGRAM UNDER THE PROJECT THEMIS. Annual Report, 1 March 1969-31 August 1969. Grannemann, W. W.; Allen, R. C. Jr.; Boatwright, L. T.; Byatt, W. J.; Southward, H. D. (New Mexico Univ., Albuquerque (USA). Bureau of Engineering Research). Sep 1969. Contract N00014-68-A-0158. 205p. NTIS $6.00.

Radiation effects research has been directed toward basic problems with dielectric materials, semiconductor materials, and solid-state devices, such as: electron transport in a one-dimensional solid; small-signal s-parameters for high-frequency transistors; eight-emitting diodes, laser diodes, and the gallium-arsenide material used in the construction of the diodes; technology for making micro-Hall devices; metal-oxide-silicon capacitors with guard rings; dielectric Hall effect devices of microcircuit size; avalanche theory; four-layer silicon-controlled rectifiers; Schottky barrier diodes fabricated on silicon and gallium phosphide; and fabrication of small radiation-resistant devices. (auth)

9385 (AD-715140) RADIATION EFFECTS RESEARCH PROGRAM. Annual Report, 1 March 1970-31 August 1970. Grannemann, W. W.; Allen, R. C. Jr.; Boatwright, L. T.; Byatt, W. J.; Southward, H. D. (New Mexico Univ., Albuquerque (USA). Bureau of Engineering Research). Sep 1970. Contract N00014-68-A-0158. 302p. NTIS $6.00.

The report includes radiation effects on GaAsP and GaP schottky barrier diodes; fabrication and electrical testing of Zn-Si and Zn-GaAsP schottky barrier diodes; the effects of neutron and gamma irradiation on diffused GaAs laser diodes; radiation damage to epitaxial silicon measured by micro-Hall devices; Hall effect in dielectric materials; conductance measurements on metal-insulator-semiconductor capacitors; metal-insulator-semiconductor (MIS) capacitor studies; transistor modeling; transient radiation effects in silicon controlled rectifiers; theory of avalanche breakdown in silicon II; particle transport and band structure within imperfect crystals; and transport equations with variable coefficients. (auth)

9386 (AD-728800) RADIATION EFFECTS ON GALLIUM ARSENIDE PHOSPHIDE AND GALLIUM PHOSPHIDE SCHOTTKY BARRIER DIODES. Technical Report. Neamen, D. A.; Grannemann, W. W. (New Mexico Univ., Albuquerque (USA). Bureau of Engineering Research). Jul 1971. Contract N00014-68-A-0158. 239p. NTIS $3.00.

Gallium arsenide phosphide (GaAsP) and gallium phosphide (GaP) Schottky barrier diodes were fabricated and the transient ionizing and stable fast neutron radiation effects on these diodes were determined. (auth)

9387 (AD-734160) RADIATION EFFECTS RESEARCH PROGRAM. Annual Report, 1 September 1970-31 August 1971. Grannemann, W. W.; Allen, R. C. Jr.; Boatwright, L. T.; Byatt, W. J.; Southward, H. D. (New Mexico Univ., Albuquerque (USA). Bureau of Engineering Research). Sep 1971. Contract N00014-68-A-0158. 173p. NTIS $3.00.

Topics include radiation effects on gallium arsenide phosphide and gallium phosphide Schottky barrier diodes; diffusion of Zn in GaAsP; low volume depletion region Schottky barrier diodes; neutron and gamma radiation effects in GaAs laser diodes and bulk materials; MIS (Metal-Insulator-Semiconductor) studies; fabrication and testing of GaAsP MIS capacitors; thermal oxidation of gallium arsenide phosphide; electron beam irradiation studies; magnetoresistance and radiation effects on electron beam evaporated high mobility thin films of indium antimonide; Hall effect in dielectric material; micro-Hall device studies; radiation effects on epitaxial silicon; semiconductor modeling study; electrons in disordered crystals; application of invariant imbedding methods to problems of transport theory and wave propagation. (NTIS)

9388 (AD-744093) MATHEMATICAL SIMULATION OF THE EFFECTS OF IONIZING RADIATION ON SEMICONDUCTORS. Final Report, 1 February 1970–31 December 1971. Kennedy, D. P. (International Business Machines Corp., Hopewell Junction, N. Y. (USA). East Fishkill Lab.). 31 Jan 1972. Contract F19628-70-C-0098. 132p. NTIS $3.00.

The report outlines results of two-dimensional mathematical investigations initiated during the present contract period: the insulated gate field-effect transistor, The Schottky barrier field-effect transistor and the bipolar transistor. In addition, information is presented on the mathematical technique used to solve these semiconductor device problems. A discussion is presented on a newly developed method for numerically solving the two-dimensional ambipolar diffusion equations for holes and electrons in semiconductor material. All numerical computations of this type use underrelaxation as a means to attain computational stability; the present discussion outlines the automation of this underrelaxation process whereby all device calculations can be performed on a "hands-off" basis. Another new aspect of this computational method is the adoption of a formulation that provides rapid convergence of the calculated electric current in investigations of semiconductor devices. (auth)

9389 (AD-747663) GALLIUM–ARSENIDE–PHOSPHIDE MIS CAPACITOR FABRICATION AND RADIATION STUDIES. Phillips, D. H.; Grannemann, W. W. (New Mexico Univ., Albuquerque (USA). Bureau of Engineering Research). May 1972. Contract N00014-68-A-0158. 312p. NTIS $6.00.

GaAsP MIS capacitors were fabricated using several dielectric-growth processes, including RF sputtering, wet oxidation, and dry oxidation of GaAsP. Depletion capacitance theory was used to calculate the neutron-induced carrier removal rate in GaAsP MIS capacitors. Annealing experiments were performed to determine whether "permanent" radiation damage could be annealed out of the GaAsP MIS capacitors. Radiation testing of GaAsP MIS capacitors and GaAsP diodes resulted in the development of a magnetic electron deflection tube, a telescoping drift tube, an electron-beam TREE test fixture, and a radiation-hardened line-driver amplifier. (auth)

9390 (AD-762482) JUNCTION CAPACITANCE TECHNIQUES TO CHARACTERIZE RADIATION DAMAGE IN SILICON. Diebold, J. W.; DeAngelis, H. M.; Kimerling, L. C.; Fitzgerald, J. J. (Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. (USA)). 12 Mar 1973. 38p. NTIS $4.00.

Capacitance-voltage and transient capacitance measurements were made on Schottky barrier-on-phosphorus-doped silicon diodes. Energy levels, emission coefficients, and associated introduction rates were determined for defects produced by 1.0-MeV electrons, Co(60)-gamma rays, and 5-MeV neutrons. Total defect introduction rates agree well with carrier removal data of companion Hall effect samples. In the electron- and gamma-irradiated samples, specific introduction data reveal radiation-induced traps at E(c)–0.24 eV, E(c)–0.44 eV, and below midgap. The introduction rate of the traps located below midgap exhibits a strong dependence on donor concentration. In neutron-irradiated, float-zoned silicon a band of shallow trap levels is evident along with levels at E(c)–0.37 eV, E(c)–0.40 eV, and below midgap. In neutron-irradiated, crucible-grown silicon, trap levels are observed at E(c)–0.18 eV, E(c)–0.23 eV, E(c)–0.24 eV, E(c)–0.31 eV, and below midgap. (auth)

9391 (PEM-22) NUCLEAR EMP: REVIEW SUMMARIES OF PEM NOTES PUBLISHED THROUGH OCTOBER 1975. Latorre, V. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Oct 1975. 16p. Dep. NTIS $4.50.

This Protection Engineering and Management Note presents brief summaries of all the PEM Notes published to date (PEM-1 through PEM-43). The notes are written, edited, or revised and published by the Lawrence Livermore Laboratory in connection with Subtask R99QAXEC091 between the Laboratory and the Defense Nuclear Agency. (auth)

9392 (PEM-39) 100-kA DIRECT DRIVE EMP PULSER. Allen, J. E. (GTE Sylvania, Inc., Needham Heights, Mass. (USA). Communication Systems Div.). Jul 1975. 29p. Dep. NTIS $5.00.

A pulser is described which was built to directly drive 100 kA into a Minuteman silo closure seal. The pulser has a 50-kV charge voltage, a 10-nanosecond rise time and a 50 microsecond fall time. Physical features and performance characteristics are described along with a summary of its successful operation in pulsing the silo cover. (auth)

9393 (UCRL-51936) ABSORPTION OF SHORT-PULSE ELECTROMAGNETIC ENERGY BY A RESISTIVELY LOADED STRAIGHT WIRE. Miller, E. K.; Deadrick, F. J.; Landt, J. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Oct 1975. Contract W-7405-Eng-48. 23p. Dep. NTIS $4.00.

Absorption of short-pulse electromagnetic energy by a resistively loaded straight wire is examined. Energy collected by the wire, load energy, peak load currents, and peak load voltages are found for a wide range of parameters, with particular emphasis on nuclear electromagnetic pulse (EMP) phenomena. A series of time-sequenced plots is used to illustrate pulse propagation on wires when loads and wire ends are encountered. (auth)

9394 CALCULATION OF THE PARTICLE FLUX AROUND THE SATELLITE GEOS AND OF THE DOSES ABSORBED BY IT. Bourriesu, J.; Philippon, J. P. (Centre d'Etudes et de Recherches, Toulouse). pp 65-78 of Evaluation of the Effect of the Space Environment on Materials. Paris; Centre National d'Etudes Spatiales (1974).

From conference on evaluation of the effect of the space environment on materials; Toulouse, France (17 Jun 1974).

The total proton and electron fluxes encountered by GEOS are evaluated, and the energy density incident on its components, especially the flexible masts, is determined. The calculations show a strong contribution by protons to the dose incurred at the surface of the parts, while electrons are found to predominate inside the various materials due to their higher penetrance. The study shows that even highly durable parts in the interior of a space vehicle can be subject to high-energy particle-induced aging during the execution of a mission, and that these parts can thus compromise the mission. (IAA)

9395 RADIATION SHIELDING FOR QUARTZ CRYSTALS IN SATELLITES. McCrary, J. H. (Naval Research Lab., Washington, DC). pp 39-44 of Evaluation of the Effect of the Space Environment on Materials. Paris; Centre National d'Etudes Spatiales (1974).

From conference on evaluation of the effect of the space environment on materials; Toulouse, France (17 Jun 1974).

The degrading effects of Van Allen radiation on the frequency characteristics of satellite-born quartz crystal oscillators can be significantly reduced by appropriate shielding. A light-weight shield capable of reducing the absorbed dose in the quartz crystal to less than a rad per day was designed for the forthcoming Navy Timation III navigational satellite. The shield consists of an aluminum-lead-aluminum configuration in which the external satellite skin is the first aluminum component and the crystal oscillator is surrounded by concentric shields of aluminum and lead. Theoretical and experimental data were obtained to determine the effectiveness of this shield as a function of the thicknesses of the three layers for various incident electron fluxes. (auth)

9396 EFFECT OF THE SILICA GROWTH MODE ON THE MECHANISMS OF DAMAGE BY IONIZING RADIATION IN MOS STRUCTURES. Sarrabayrouse, G.; Buxo, J. (CNRS, Toulouse, France). pp 777-784 of Evaluation of the Effect of the Space Environment on Materials. Paris; Centre National d'Etudes Spatiales (1974). (In French)

From conference on evaluation of the effect of the space environment on materials; Toulouse, France (17 Jun 1974).

The study concerns the influence of some of the technological parameters involved in the MOS process on the radiation sensitivity of MOS capacitors. The parameters considered are: (1) the nature of the metallic electrode, and (2) the water content of the oxide film. The influence of thermal post-oxidation treatments is also discussed. The results obtained show that, in the case of wet oxides which have not had post-oxidation treatments, the extent of the degradation effect is controlled by the conditions of humidity under which the oxide is obtained and by the chemical reactivity of the metallic electrode. The role of ionic phenomena in these experiments is discussed. (auth)

9397 PREDICTION OF GAIN DEGRADATION OF BIPOLAR TRANSISTORS BY NEUTRONS: INFLUENCE OF THE SPECTRUM AND CORRELATION WITH ELECTRICAL PARAMETERS. Burkhart, A. (CEN, Essonne, France). pp 807-812 of Evaluation of the Effect of the Space Environment on Materials. Paris; Centre National d'Etudes Spatiales (1974). (In French)

From conference on evaluation of the effect of the space environment on materials; Toulouse, France (17 Jun 1974).

9398 IRRADIATION TEST PROCEDURE AND RELIABILITY ASPECTS OF ELECTRONIC DEVICES FOR THE SYMPHONIE SATELLITE. Spencker, A.; Draunig, D.; Wagemann, H. G. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). pp 765-775 of Evaluation of the Effect of the Space Environment on Materials. Paris; Centre National d'Etudes Spatiales (1974).

Qualification lots of electronic components, including resistors, capacitors, connectors and thermistors, diodes, bipolar and unipolar transistors, and logic and opto-electronic devices were

subjected to two-step electron irradiation of at least 1 MeV under test conditions identical with the COMSAT-spectrum for an equatorial synchrotron orbit. All components except high voltage diodes and thermistors were shielded. Dosimetry, irradiation simulation, and test procedures are described, and results are tabulated. It was found that passive components, diodes, junction FETs, and TTL ICs suffered no damage; transistors were very sensitive to ionization; the tested optocoupler was unsuitable; and one out of ten high voltage diodes experienced catastrophic damage. Evaluation of shielding for optocouplers and the maverick selection of high voltage diodes are described. (IAA)

9399 IRRADIATION BEHAVIOR OF COMPLEMENTARY METAL OXIDE SEMICONDUCTOR FIELD EFFECT (CMOS) DEVICES. Wagemann, H. G.; Braunig, D.; Kampf, U.; Spenker, A. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). pp 785-796 of Evaluation of the Effect of the Space Environment on Materials. Paris; Centre National d'Etudes Spatiales (1974).

From conference on evaluation of the effect of the space environment on materials; Toulouse, France (17 Jun 1974).

9400 EFFECT OF MIXED RADIATION FIELDS ON ELECTRONIC DEVICES. Schonbacher, H.; Lambert, K. P.; van de Voorde, M. (Organisation Europeenne de Recherches Nucleaires, Prevessin, France). pp 755-764 of Evaluation of the Effect of the Space Environment on Materials. Paris; Centre National d'Etudes Spatiales (1974).

From conference on evaluation of the effect of the space environment on materials; Toulouse, France (17 Jun 1974).

The successful operation of high-energy particle accelerators and storage rings depends upon the reliability of electronic devices. Primary high-energy protons, which are lost during machine operation, produce secondary particle fluxes of protons, neutrons, pions, gammas, etc., sufficiently high to seriously affect the performance of electronic devices. In order to avoid drastic failure during machine operation due to radiation damage of electronic components, simulation tests have been carried out in different radiation sources, for example, nuclear reactors, near the existing CERN accelerators and in gamma irradiators. The performance of individual components, such as diodes, capacitors, transistors and integrated circuits was studied under different sources and conditions. The results of these investigations are given as well as a comparison of damage effects in different radiation environments. (auth)

9401 IRRADIATION EXPERIMENTS WITH COSMOS CIRCUITS USING A STRONTIUM SOURCE. Ponomarenko, S. (Centre National d'Etudes Spatiales, Toulouse). pp 737-754 of Evaluation of the Effect of the Space Environment on Materials. Paris; Centre National d'Etudes Spatiales (1974). (In French)

From conference on evaluation of the effect of the space environment on materials; Toulouse, France (17 Jun 1974).

Integrated logic CMOS (complementary MOS) circuits were exposed to two modes of radiation from a 1-curie Sr-90 source. The changes observed in the groups of components tested are described in terms of the electric parameters. Large discrepancies in the effects of radiation are observed for components belonging to the same group. (IAA)

9402 FROM RADIATION HARDENING TO IONIZING RADIATION OF QUARTZ RESONATORS. King, J. C. (Sandia Labs., Albuquerque, NM). pp 181-208 of Evaluation of the Effect of the Space Environment on Materials. Paris; Centre National d'Etudes Spatiales (1974).

From conference on evaluation of the effects of the space environment on materials; Toulouse, France (17 Jun 1974).

Accumulated performance data on the stability of quartz resonators in earth orbiting satellites, as well as similar information gained from deep space probes, underscore the importance of reducing the effects of ionizing radiation on these critical system components. This paper briefly reviews the phenomenological response of precision AT-cut resonator to both steady state and pulsed radiation. The resultant frequency offset and change in resonator Q have been interpreted in terms of radiation-induced changes in certain point defects in the quartz crystal structure. These defects involve interstitial monovalent cations which can be removed by solid diffusion along the optic axis at elevated temperatures in the presence of an electric field. High-Q precision resonators fabricated from such swept quartz exhibit an extraordinary insensitivity to ionizing radiation relative to untreated quartz. (auth)

Miscellaneous Instruments

Refer also to abstracts 11210, 11274, 11276, 11277, and 11385.

9403 (CEA-CONF-2999) MATHEMATICAL MODEL FOR TRANSDUCER WORKING AT HIGH TEMPERATURE. Fabre, J. P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13-Saint-Paul-les-Durance (France). Dept. des Reacteurs a Neutrons Rapides). 21 Jun 1974. 6p. (In French). INIS.

From conference on reactor inspection; Bristol, UK (26 Feb 1975).

A mathematical model is proposed for a lithium niobate piezoelectric transducer working at high temperature in liquid sodium. The model proposed suitably describes the operation of the high temperature transducer presented; it allows the optimization of the efficiency and band-pass. (FR)

9404 (CEA-CONF-3027) AUTOMATIC MEASUREMENT. Ringeard, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Services d'Electronique). 28 Nov 1974. 31p. (In French). INIS.

From meeting on automatic measurements; Saclay, France (27 Feb 1975).

By its ability to link-up operations sequentially and memorize the data collected, the computer can introduce a statistical approach in the evaluation of a result. To benefit fully from the advantages of automation, a special effort was made to reduce the programming time to a minimum and to simplify link-ups between the existing system and instruments from different sources. The practical solution of the test laboratory of the C. E. A. Centralized Administration Groupe (GEC) is given. (FR)

9405 (CRN-CNPA-75-11) TIME OF FLIGHT MASS SPECTROMETER WITH PARTICLE GUIDE. Igersheim, R.; Abbe, J. C.; Paulus, J. M. (Centre National de la Recherche Scientifique, 67-Strasbourg (France). Centre de Recherches Nucleaires). 1975. 25p. (In French). INIS.

Two time of flight mass spectrometers have been designed. The first one consists of an arrangement of a pulsed ion source, an electrostatic particle guide and a detector; an ion reflector was added in the second apparatus. The supply of a particle guide appears to be particularly efficient in the second case for the analysis of low energy beams. The higher the initial kinetic energy of the ions, the more important is the corresponding increase in sensitivity. (FR)

9406 A SIMPLE METHOD FOR AUTOMATIC MEASUREMENT OF EXCITATION FUNCTIONS. Ogawa, M.; Adachi, M.; Arai, E. (Tokyo Inst. of Tech. (Japan)). Nucl. Instrum. Methods; 127: No. 2, 217-219(1 Aug 1975).

An apparatus has been constructed to perform the sequence control of a beam-analysing magnet for automatic excitation function measurements. This device is also applied to the feedback control of the magnet to lock the beam energy. (NL)

9407 NEUTRON DIFFRACTION UNIT HAVING THE MONOCHROMATOR INSIDE THE REACTOR SHIELD. Karimov, I. A.; Em, V. T.; Petrunin, V. F. (Inst. of Nuclear Physics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 6, 68-69 (1974). (In Russian).

A description is given of a neutron diffraction unit mounted in the horizontal channel of a reactor, in which the intensity of the neutron beam reflected from the monochromator has been increased by a factor of ~2 because of an improvement in geometry. By slight modifications to the thermal column it was possible to place the monochromator inside the reactor shield close to the active zone. All the free space within the thermal column is filled with solid shields made of steel and a boron-paraffin mixture to decrease the background. A device is provided for remote-controlled manipulation of the monochromator. A sliding gate 25 cm thick is mounted in front of the crystal monochromator for changing out the monochromator at zero reactor power. The contribution of second-order reflexion neutrons is 0.7% at a neutron wavelength of 1.078 Å. (SJR).

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Isotope Separation (Industrial)

Refer also to abstract 8900.

9408 (NP-20736) TWO-PHOTON LASER ISOTOPE SEPARATION OF ATOMIC URANIUM-SPECTROSCOPIC STUDIES, EXCITED STATE LIFETIMES, AND PHOTOIONIZATION CROSS SECTIONS. Janes, G. S.; Itzkan, I.; Pike, C. T.; Levy, R. H.; Levin, L. (Avco-Everett Research Lab., Everett, Mass. (USA)). May 1975. 43p. Avco-Everett Research Lab., Inc., Everett, MA.

For Jersey Nuclear-Avco Isotopes, Inc., Bellevue, WA.

Experimental studies are described wherein an atomic beam of uranium vapor produced by electron beam evaporation is selectively excited and ionized by light from two short-pulse, narrow bandwidth, tuned dye lasers, and detected and analyzed by a mass spectrometer. The total number of ions per pulse produced is small; however, the time of production is known precisely. By counting single ions, using digital logic and multiplexing the mass spectrometer between ^{238}U and ^{235}U, it is possible to measure isotope ratios as a function of exciter wavelength, and to correct for background effects and spurious ions. These results demonstrated 50 percent enrichment of $^{235}U/^{238}U$. Excited state lifetimes were measured by observing yields as a function of the delay between the two laser pulses. In addition, for an excitation wavelength of 4266.325 A the variation of two-step photoionization efficiency was measured as a function of the wavelength of the ionizing laser. The maximum yield at an ionizing wavelength of 3609 A corresponds to a cross section of 2×10^{-17} cm^2 for matched linewidths. Also, the ionization potential of uranium was determined to be 6.187 +- .002 eV. (auth)

9409 VORTEX NOZZLE PROCESS FOR URANIUM ENRICHMENT. Fuhse, W. A. Atomkernenergie; 26: No. 1, 69(Aug 1975). (In German)

4 refs.

The concept of the "vortex nozzle process," the patent rights for which have been claimed, is discussed. This method and the centrifugal method developed in South Africa, details of which have not yet been published, are compared. (GE)

9410 URANIUM ENRICHMENT 1975. Koske, P. H. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). Atomkernenergie; 25: No. 3, A18(1975). (In German)

From international conference on uranium isotope separation; London, UK (5 Mar 1975)

A short review is presented of the "International Conference on Uranium Isotope Separation" which was held in London from the 5th to the 7th of March, 1975, as the first European conference of its kind. (GE)

9411 ISOTOPE SEPARATION. II. Optical Methods. Fricke, J. Phys. Unserer Zeit; 6: No. 4, 118-125(Jul 1975). (In German)

19 figs.; 11 refs.

A survey on the optical methods for isotope separation is given in this work. In particular isotope separation by photon absorption during irradiation of a collimated atom beam with the dye laser radiation of the absorption frequency is dealt with. (GE)

9412 ISOTOPE SEPARATION. I. Classical Methods. Treml, K. Phys. Unserer Zeit; 6: No. 4, 110-117(Jul 1975). (In German)

8 figs.; 4 tabs.; 7 refs.

A survey is given on the classical, physical and chemical methods of isotope separation. The principles of electromagnetic mass separation, of diffusion, centrifugal method and of the chemical isotope separation as well as a cost comparison for the enrichment of uranium by the various processes are explained. (GE)

9413 ISOTOPE SEPARATION BY MEANS OF LASERS. Walther, H. (Koeln Univ. (F. R. Germany). 1. Physikalisches Inst.). Kerntechnik; 17: No. 6, 253-259(Jun 1975). (In German, English)

5 figs.; 1 tab.; 31 refs.

A survey of the methods of isotope separation by means of lasers which are known today is presented. The basic principles involved are described briefly and the results achieved are discussed. (auth)

9414 EXTRACTION ELECTRODE GEOMETRY FOR A CALUTRON. Veach, A. M.; Bell, W. A. Jr. (to U. S. Energy Research and Development Administration). US Patent 3,908,123. H01J39/34. 23 Sep 1975. Filed Date 16 Apr 1974. 6p.

PAT-APPL-461,472.

This patent relates to an improved geometry for the extraction electrode and the ground electrode utilized in the operation of a calutron. The improved electrodes are constructed in a partial-picture-frame fashion with the slits of both electrodes formed by two tungsten elongated rods. Additional parallel spaced-apart rods in each electrode are used to establish equipotential surfaces over the rest of the front of the ion source. (auth)

Isotopic Power Sources

Refer also to abstract 9797.

9415 (BNWL-1845-14) PACIFIC NORTHWEST LABORATORY QUARTERLY REPORT TO ADVANCED NUCLEAR ENERGY SYSTEMS, SPACE AND SPECIAL PURPOSES DIVISION. Jarrett, J. H.; Harmon, K. M. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 30 Jun 1975. Contract E(45-1)-1830. 16p. Dep. NTIS $4.00.

Progress during the fourth quarter of FY-1975 in research on the utilization of nuclear by-products is reported. Preliminary conceptual and engineering analysis studies were made of a proposed U.S. Air Force 2kW(e) power system employing Waste Encapsulation and Storage Facility (WESF) $^{90}SrF_2$ capsules as a source of heat. The results showed the feasibility of such a system, but indicated that the SrF_2 capsule materials might have to be changed to satisfy operating life requirements. Dose rates from a WESF $^{90}SrF_2$ capsule were measured. Dose rates and radiation efficiences for WESF $^{137}CsCl$ capsules of varying geometries were calculated. A forecast of the potential supply of a number of beneficial reactor by-products was assembled. A start was made on the definitions of a flow sheet for an integrated reactor by-product recovery plant. Preliminary work was done on the methodology for forecasting long-term demand for reactor by-products. (auth)

9416 (JPL-4) PROGRAM OF THERMOELECTRIC GENERATOR TESTING AND RTG DEGRADATION MECHANISMS EVALUATION. Progress Report No. 14. (Jet Propulsion Lab., Pasadena, Calif. (USA)). Nov 1975. Contract AT(04-3)-959. 58p. Dep. NTIS $5.50.

Progress during September and October 1975 in the development and evaluation of thermoelectric generators for use with radioisotope heat sources is reported. Information is included on: the operation of Si_3N_4-coated SiGe legs in vacuum and in CO; selenide material evaluation tests; and the performance testing of thermoelectric generators representing SiGe and PbTe advanced technology. (LCL)

9417 NUCLEAR-FUELED CIRCULATORY SUPPORT SYSTEMS. XII. Current Status. Hughes, D. A.; Faeser, R. J.; Daly, B. D. T. (Cardiovascular Surgical Research Labs., Houston, TX). Trans. Am. Soc. Artif. Intern. Organs.; 20: 737-746 (1974).

Our laboratories have been engaged in development and in vivo testing of nuclear-fueled circulatory support systems. These efforts have focused on 4 major areas: (1) evaluations of the biologic effects of chronic intracorporeal heat and radiation; (2) the development of efficient and reliable energy converters (engines); (3) evaluations of the biocompatibility of the various system components, and (4) investigations of the hemodynamic effectiveness of the system in vivo. Previous in vivo experiments have been reported. Three systems are currently under investigation; each has undergone a number of modifications to improve overall thermal-mechanical efficiencies or to decrease physiologic alterations resulting from system size, intracorporeal heat and interactions between the prostheses and experimental animals. The purpose of this paper is to characterize the current systems and describe recent in vivo experiments. (auth)

9418 RADIOISOTOPIC HEAT SOURCE. Jones, G. J.; Selle, J. E.; Teaney, P. E. (to U. S. Energy Research and Development Administration). US Patent 3,909,617. G21H5/00. 30 Sep 1975. Filed Date 30 May 1974. 8p.

PAT-APPL-474,548.

Disclosed is a radioisotopic heat source and method for a long life electrical generator. The source includes plutonium dioxide shards and yttrium or hafnium in a container of tantalum-tungsten-hafnium alloy, all being in a nickel alloy outer container, and subjected to heat treatment of from about 1570^{0}F to about 1720^{0}F for about one h. (auth)

Radiation Sources

Refer also to abstract 9103.

9419 CORRECTION FOR SELF ABSORPTION IN ALPHA SOURCES. Raghavayya, M.; Jha, G.; Markose, P. M. (Bhabha Atomic Research Center, Bombay). Health Phys.; 29: No. 5, 782-785(Nov 1975).

With a view to simplifying the procedure for alpha source evaluation, a correction factor which can be used to correct for losses due to self-absorption of alpha particles in sources of any thickness even greater than the limiting thickness, or the range of alpha particles in the source material, is derived. The method was verified using uranium sources of thickness 0.46 to 7.19 mg/cm^2. The results are tabulated from which it is seen that the application of the correction as described yields results within about 5%. (UK)

9420 BENT COPPER MONOCHROMATORS FOR NEUTRONS. Hohlwein, D. (Inst. Max von Lave, Grenoble, France). J. Appl. Crystallogr.; 8: No. 4, 465-468(1 Aug 1975). (In German)

A simple device is described which allows copper crystals to be bent elastically and plastically with cylindrical curvature down to a radius of 1 m, without destroying the homogeneity of the mosaic structure. This is proved by measurements with a γ-diffractometer. The focusing behaviour of a bent monochromator, designed for the modified Laue technique, is as expected and the crystal reflects nearly homogeneous neutrons in the wavelength band 1.3 ± 0.05 Å with a reflectivity of 30%. (auth)

Design and Fabrication

Refer also to abstracts 9099, 9102, 9104–9111, and 9453–9463.

9421 A NEW HIGH-RESOLUTION GAMMA-RAY MONOCHROMATOR. Moreh, R.; Jacob, I.; Mourad, R. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). Nucl. Instrum. Methods; 127: No. 2, 193-203(1 Aug 1975).

A high resolution gamma monochromator having a resolution of approximately 10^{-4} is described. The variable energy γ source is obtained by nuclear resonance scattering of neutron-capture γ rays through various scattering angles. Several possible combinations of γ sources and resonance scatterers are discussed. In particular, a lead target was employed to scatter the 7.28 MeV γ line of neutron-capture γ rays of iron. Variation of the angle of the resonantly scattered 7.28 MeV photons between 60° and 150° permits an energy scan of 400eV in any absorber. Thus, nuclear energy levels in some absorbers are photoexcited, and the corresponding ground state widths are extracted from the measured absorption spectrum. The results for the case of a Ce absorber are discussed in detail. (NL)

LIFE SCIENCES

9422 RADIATION RISKS: A POSSIBLE TEACHING TOPIC. Howes, R. W. (South London Coll.). Phys. Educ.; 10: No. 6, 412-416(Sep 1975).

Radiation risks have been the subject of hot debate since 1969 due mainly to the energy crisis and the switch to nuclear power. Topics of this debate, including the controversy concerned with the delayed radiobiological effects of low level radiation, the social responsibility of modern scientists, the sometimes acrimonious discussion which has taken place over many years concerning radiation standards, and present day misgivings over the environmental aspect of the nuclear power programme, are discussed and suggestions are made of ways in which the topics could be introduced into teaching courses. (UK)

Radiation Effects on Biochemicals

Refer also to abstracts 9442, 9447, and 9452.

9423 (JPRS-65988, pp 130-133) EFFECT OF VIBRATION, ACCELERATION, AND ACUTE IRRADIATION IN A DOSE OF 250 R ON THE LOCALIZATION AND ACTIVITY OF SOME LIVER ENZYMES IN SEXUALLY MATURE RABBITS. Yuy, R. I.; Denisov, V. I.; Fedotovskikh, G. V. 22 Oct 1975. Translated from Kosm. Biol. Aviakosmicheskaya Med.; 9: No. 4, 80-81(1975).

In Space Biology and Aerospace Medicine.

Rabbits were exposed to vibrations of 50 Hz × 0.5 mm × 15 min and acceleration of 8 g × 3 min; one hr later they were exposed to 250 R radiation. Observations were made on localization and activity of cytochrome oxidase, succinate dehydrogenase, acidic and alkaline phosphatases, esterases, glucose-6-phosphatase, and ATP-ase in the liver. Changes in the localization and activity of enzymes after exposure to dynamic factors and radiation indicated that there was a depression of tissue respiration, swelling of mitochondria, and a change in permeability of lysosomes in the liver. (HLW)

9424 ENERGY REQUIREMENTS FOR DAMAGING DNA MOLECULES. The Mechanisms of Inactivation of Bacteriophage ϕX 174 DNA by Vacuum Ultraviolet Radiation. Sontag, W.; Dertinger, H. (Kernforschungszentrum, Karlsruhe, Ger.). Int. J. Radiat. Biol.; 27: No. 6, 543-552(Jun 1975).

Strand break formation and biological inactivation of infectious DNA of bacteriophage ϕX 174 exposed to vacuum-ultraviolet radiation of 4.9 to 21.2 eV quantum energy has been investigated. At 21.2 eV as many as 84 per cent of the DNA molecules were inactivated by breaks whereas breaks did not contribute to inactivation at 4.9 eV. The quantum yield of break formation increased from 1.7×10^{-5} (4.9 eV) to 0.55 (21.2 eV) and showed a dependence on energy similar to that of electron emission (due to ionization) above 8 eV. The mechanisms leading to break formation and inactivation are discussed taking the absorption spectrum of DNA in the vacuum-ultraviolet region into consideration. (auth)

9425 RADIATION INACTIVATION OF RABBIT MUSCLE ALDOLASE. Felicioli, R. (Consiglio Nazionale delle Ricerche, Pisa, Italy); Montagnoli, G.; Monti, S.; Moore, J. S.; Phillips, G. O.; Sosnowski, A. Int. J. Radiat. Biol.; 27: No. 6, 525-532 (Jun 1975).

Pulse radiolysis and steady-state x radiolysis have been used to investigate the radiation inactivation of aldolase from rabbit muscle. Both e^-_{aq} and OH readily reacted with aldolase, and contributed to inactivation. The radical anions $(CNS)^-_2$ and $(Br)^-_2$ reacted with aldolase at neutral pH. The progressive addition of alkali resulted in an increase in the second-order rate constants, with an apparent pK ~10 ± 0.3, and with the formation of an unstable intermediate, $\lambda_{max} \sim 400$ nm resembling a phenoxyl radical. Steady-state radiolysis in the presence of $(CNS)^-_2$ and $(Br)^-_2$ at alkaline pH resulted in increased aldolase inactivation, with a pK of enzyme inactivation similar to that observed for reaction of the radical anions. We propose that a reaction of the radical anions with tyrosine residues accounted for the resultant inactivation. (auth)

9426 PHOTOSENSITIZING PROPERTIES OF N-FORML-KYNURENINE. Walrant, P. (Michael Reese Hospital, Chicago); Santus, R.; Grossweiner, L. I. Photochem. Photobiol.; 22: No. 1-2, 63-65(Jul 1975).

UV-irradiation of tryptophan (Trp) or tryptophyl residues in proteins is known to lead to N-formylkynurenine (FK) as an oxidation product. A uv flash photolysis investigation of the "non-singlet oxygen" process by which FK sensitizes the photooxidation of Trp has confirmed that this photosensitization occurs via the triplet state ^{3}FK under anaerobic conditions. A reaction scheme is proposed for the internal photosensitization in bovine carbonic anhydrase (BCA) and other tryptophan-containing proteins. According to this scheme FK is produced by "direct" photooxidation of Trp and from the attack of O^-_2 on Trp generated in turn by the reaction of primary product e^-_{aq} with oxygen and also the oxidation of the FK semiquinone radical, FKH'. Similar pathways of internal photosensitization may take place in other enzymes, but are likely to be less important than BCA which displays an unusual dependence of photoinactivation quantum yield on oxygen. (UK)

9427 PHOTOCHEMISTRY OF BIOLOGICAL MOLECULES. V. A Mechanistic Study of the Photolysis of Cycloalanylalanine in the Solid State. Johns, R. B.; McGregor, J. W. (Melbourne Univ.). Photochem. Photobiol.; 22: No. 1-2, 13-17(Jul 1975).

Earlier studies of the photodamage induced by 254 nm irradiation of linear alanine peptides in the solid state have been supplemented by an investigation into the gaseous photoproducts from the cyclic dipeptide, 3,6-dimethyl-2,5-diketopiperazine. The trans and cis isomers have been prepared and the photoproducts compared with those from the DL-mixture. The conformation of the molecule did influence the yield of gaseous products. CO was produced by peptide bond rupture with concomitant release of hydrogen. CO_2 was also produced. The use of N- and C-deuterated analogues together with relevant crystallographic and EPR data has enabled a detailed study of the mechanism of photodegradation to be made, from which it was concluded that the methyl protons are not inert but rather are the major source of the hydrogen observed on photolysis. (auth)

9428 CHANGES IN DNA SECONDARY STRUCTURE AFTER γ IRRADIATION. Frey, R.; Hagen, U. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Strahlenbiologie). Radiat. Environ. Biophys.; 12: No. 2, 111-118(Jul 1975).

5 figs.; 2 tabs.; 20 refs.

Native calf thymus DNA was γ-irradiated at 500 μg/ml in 0.01 M NaCl in the presence or absence of oxygen. By irradiation, an increasing amount of DNA becomes reactive with a water-soluble carbodiimide-derivate (CMEC). In the DNA sections reactive with CMEC the nucleotide strands are separated, a phenomenon previously described as radiation-induced denaturation. The dose-effect curve for the formation of denatured DNA shows an upward-bent form; a distinct oxygen effect of about 2 is observed. By a comparative study with DNA samples, degraded partially with DNAse I, it was shown that a minor part of the radiation-induced denaturation results from the formation of radiation-induced single strand breaks, whereas the major part is a local denaturation independent of the strand breaks. In these locally denatured regions 20 to 50 nucleotide pairs are separated. (auth)

9429 THIAMINE IN IRRADIATED FOODSTUFFS. I. Influence of Different Radiation Conditions and of Time After Irradiation. Diehl, J. F. (Bundesforschungsanstalt fuer Ernaehrung, Karlsruhe (F. R. Germany). Inst. fuer Strahlentechnologie). Z. Lebensm.-Untersuch.-Forsch.; 157: No. 6, 317-321(Jun 1975). (In German)

3 figs.; 3 tabs.; 19 refs.

Effects of 10 MeV-electron radiation on thiamine dichloride in crystalline form and in solution, and on thiamine in dried whole egg are described. Both in the dry state and in aqueous solutions, radiation induced reactions continue to affect thiamine over a considerable period of time after irradiation. Thiamine losses decrease in the order: dry thiamine dichloride, aqueous solution, hydrochloric acid solution, dried whole egg. (auth)

9430 ELECTRON TRANSFER FROM PYRIDINYL RADICALS TO CYTOCHROME-C. Land, E. J.; Swallow, A. J. (Christie Hospital and Holt Radium Inst., Manchester (UK). Paterson Labs.). Ber. Bunsenges. Phys. Chem.; 79: No. 5, 436-437(May 1975).

1 tab.; 15 refs.

Rate constants for the reduction of cytochrome-c by various pyridinyl radicals have been measured by pulse radiolysis. Radicals formed by adding an electron to bipyridylium compounds reduce cytochrome-c with rate constants of 1.4 to 2.1×10^8 l mol^{-1}sec^{-1}. Radicals formed by adding an electron to compounds possessing one pyridine ring reduce cytochrome-c with rate constants of 7.2 to 9.4×10^8 l mol^{-1}sec^{-1}. (auth)

9431 THERMOLUMINESCENCE OF ROOM TEMPERATURE, ^{60}Co GAMMA IRRADIATED DRY-STATE DNA. Dolecek, E. H. New Brunswick, NJ; Rutgers—the State Univ. (1975). 112p. University Microfilms Order No. 75-17,440.

Thesis (Ph.D.).

Understanding and evaluating the damage to the genetic population by ionizing radiation is of fundamental concern to the scientific community. If the exposure received by DNA could be determined directly, then a better estimate might be made concerning the hazard of ionizing radiation to the genetic population. This thesis reports studies on the thermoluminescence of DNA which have been carried out in order to evaluate the relevance of the thermoluminescent phenomenon for exposure analysis. The author has investigated, via the use of a modified commercial thermoluminescent reader, the thermoluminescence emitted from dry-state DNA irradiated with ^{60}Co gammas at room temperature (293^0K), and subsequently heated from 293^0K to above 393^0K. DNA thermoluminescence is found to exhibit properties of multiple decay rates, light and temperature sensitivity, radiationless transitions, multiple thermoluminescent trap availability, and supralinearity. Thermoluminescent response is relatively insensitive to molecular weight differences, but the relative sensitivity can be markedly affected if the DNA is physically and/or chemically treated subsequent to irradiation. Actual employment of the thermoluminescence from irradiated DNA as a direct in vivo dosimeter does not, at this point, seem to the author as a viable technique. However, correlation between the thermoluminescent output of DNA under various simulated in vivo configurations may yield basic information as to the types of energy pathways available to the biological system which can dissipate the energy deposited by the ionizing radiation; perhaps protecting the macromolecule from functional disability. (ERB)

9432 HYDRODYNAMIC PROPERTIES OF DNA FROM E. COLI STRAINS OF DIFFERENT RADIOSENSITIVITY AND MATRIX SYNTHESIS OF RNA IN VITRO. Barenfel'd, L. S.; Barskaya, T. V. (Cytology Inst., Leningrad). Dokl. Biol. Sci.; 221: No. 1-6, 126-128(1975).

Translated from Dokl. Akad. Nauk SSSR; 221: No. 6, 1444-1447 (Apr 1975).

The restoration of matrix activity to the DNA of E. coli radioresistant strain B/r depends on the irradiation dose. The DNA matrix activity of E. coli B/r is almost completely restored if irradiation at 10 kR is followed by incubation. However, it is possible that the number and length of the changes, and also the base composition of the newly synthesized RNA, may be different. Our results suggest that the repair of DNA after irradiation of this bacterial strain at 20 kR does not restore the structure of DNA to its previous state. (auth)

9433 EFFECT OF RADIATION ON PROCESSING OF NUCLEAR RNA AND CHROMATIN RIBONUCLEASE ACTIVITY IN RAT LIVER AND THYMUS. Tokarskaya, V. I.; Skotnikova, O. I.; Umanskii, S. R. (Inst. of Biological Physics, Moscow). Int. J. Radiat. Biol.; 27: No. 6, 533-542(Jun 1975).

The effect of radiation on the kinetics of nuclear RNA degradation was studied during actinomycin chase. The intranuclear breakdown of RNA in thymus was inhibited for the first 30 to 120 min after 800 R irradiation of rats. In liver the degradation of nuclear RNA was unchanged for 60 min after irradiation. By the second hour, the breakdown of the rRNA precursor accelerated and the processing of D-RNA slowed down. Rat thymus and liver chromatin showed RNAase activity with two optimal pH values — in the acidic (pH 5.0 to 5.5) and weakly alkaline (pH 7.5) regions. The activity of the acidic RNAase of thymus (but not the liver) chromatin fell after 5 to 20 kR irradiation in vitro. The activity of the alkaline RNAase did not change under these conditions. The data indicate that a fall in activity of the acidic RNAase in irradiated thymus chromatin may be related to disturbance in the enzyme-inhibitor interaction. A possible contribution of the chromatin acidic RNAase to the processing of nuclear RNA in control and after irradiation is discussed. (auth)

9434 EFFECT OF THE LIPID PEROXIDATION ON THE RESPIRATORY CONTROL IN RAT LIVER MITOCHONDRIA. Vladimirov, Yu. A.; Cheremisina, Z. P. (Moscow Medical Inst.). Stud. Biophys.; 49: No. 3, 161-175(14 Jul 1975).

The effect of lipid peroxidation induced by ferrous ions and ascorbate on the respiration of mitochondria in states 3 and 4 was investigated. The lipid peroxidation was found to increase the rate of oxygen uptake in state 4. In the medium containing KCl, NaCl, or choline chloride (but not in the succrose medium) it also resulted in inhibition of oxygen consumption at phosphorylating state 3, which could be reversed to some extent by addition of cytochrome c. All these effects were observed only after "slow flash" of chemiluminescence, and the degree of the alterations correlated with accumulated amounts of lipid peroxidation products (malonic dialdehyde). The effects in different media (KCl, NaCl or choline chloride) were indistinguishable. Phospholipids, isolated from mitochondria, where lipid peroxidation products had been accumulated, as well as phospholipids peroxidized under ultraviolet irradiation formed artificial bimolecular membranes, whose electrical resistance was but negligibly altered as compared with undamaged mitochondrial phospholipids. The data obtained suggest that lipid peroxidation in mitochondria results in increase in ionic permeability of mitochondrial membranes. (auth)

9435 PHOTOSENSITIZED FORMATION OF FREE RADICALS OF THE PEPTIDE GROUP IN AMIDES, PEPTIDES, AND PROTEINS. II. Peptides. Kayushin, L. P.; Ilyasova, V. B.; Azizova, O. A. (Inst. of Biological Physics, Puscino, USSR). Stud. Biophys.; 49: No. 3, 187-198(14 Jul 1975).

Photosensitized reactions in aqueous solutions of tryptophan with some aliphatic peptides uv-irradiated at 77°K were investigated. Electrons formed upon photoionization of tryptophan were found to attach to HN_3^+-groups of aliphatic peptides with subsequent breaking away of a NH_3^+ group and formation of the $CHR_aCONHCHR_aCOO^-$ radicals, where R_a is an amino acid residue. Beside this reaction in the peptides the formation of radicals of the peptide group $-CH(R_a)-\dot{C}(O^-)(H^+)-NH-$ is also observed due to the attachment of the electron to the CONH-group with subsequent protonation of the radical formed. After irradiation with the light ~365 nm the radicals of the peptide group dissociate with the rupture of the C–N–bond and formation of the radicals $R\,CH-\dot{C}=O$, the latter dissociating under the action of light $\lambda > 520$ nm to break the C–C–bond. The mechanism of photosensitized formation of the radicals and that of the reaction of these radicals in the peptides is suggested. (auth)

9436 PHOTOSENSITIZED FORMATION OF RADICALS OF THE PEPTIDE GROUP IN AMIDES, PEPTIDES, AND PROTEINS. III. Paramagnetic Centers in Proteins Irradiated with 297 nm Light. Kayushin, L. P.; Azizova, A. O.; Sud'bina, E. N. (Inst. of Biological Physics, Puscino, USSR). Stud. Biophys.; 49: No. 3, 199-214(14 Jul 1975).

The primary paramagnetic centres and their reactions in proteins irradiated with uv-light were studied by the use of electron spin resonance spectroscopy. Aromatic amino acid residues in proteins were revealed to initiate the formation of radicals $-CH(R_a)-\dot{C}(O^-)(H^+)-NH-$ (I) of the peptide group under the absorption of the uv-quantum at 77°K. Radicals are formed due to electron attachment to the –CONH-group. Under the action of 365 nm light radicals of a peptide group transform to the radicals $-CH(R_a)-C=O$ (II) as a result of cleavage of the C–N bond. Paramagnetic centres of type II decay after subsequent irradiation at $\lambda \geq 550$ nm with cleavage of the C–C bond. Radicals of type I are stable up to 220°K. When warmed to 300°K, proteins irradiated at 77°K with 297 nm light absorbed by aromatic amino acid yield paramagnetic centres RS with an unpaired electron localized on sulphur-containing amino acid residues. The mechanism of radical formation and transformations in uv-irradiated proteins is discussed. (auth)

9437 PHOTOFRAGMENTATION AND PHOTOAFFINITY LABELING OF PHENACYL AND NAPHTHACYL alpha-CHYMOTROPSINS. Glover, G. I.; Mariano, P. S.; Wilkinson, T. J.; Hildreth, R. A.; Lowe, T. W. (Texas A and M Univ., College Station). Arch. Biochem. Biophys.; 162: 73-82(1974).

The photochemistry of phenacyl, 1-, and 2-napthacyl alpha-chymotrypsins has been studied using light of wavelengths greater than 310 nm. Irradiation of these modified enzymes, having aracyl chromophores covalently bound at Met-192, led to partial regeneration of their esterase activity. The initial rates of photoreactivation have been found to be dependent on the hydrogen ion concentration and on the presence of potential competitive inhibitors having triplet energies lower than the chromophores initially receiving the light energy. Irradiation of carbonyl-^{14}C-labeled phenacyl alpha-chymotrypsin resulted in partial loss of this radiolabeled from the protein at a rate concurrent with the increase in esterase activity. These results have been interpreted and discussed in terms of a dual photochemical behavior of these modified enzymes involving (1) cleavage of the Met-192 sulfur–phenacyl alpha-carbon bond leading to liberation of alpha-chymotrypsin and substituted phenone(s) and (2) photoaffinity labeling of one or more of the functional groups in the enzyme active-site region. (auth)

9438 ESR AND ENDOR STUDIES OF RADIATION DAMAGE IN X-IRRADIATED SULFUR-CONTAINING NUCLEIC ACID DERIVATIVES. Pugh, H. L. Jr. University, AL; Univ. of Alabama (1974). 194p. University Microfilms Order No. 75-18,299.

Thesis (Ph. D.).

Single crystals of four sulfur-containing nucleic acid analogs, thioguanine (6TG), 6-mercaptopurine (6MP), 6-methylmercapto-

purine (6MeMP), and 6-methyl-mercaptopurine riboside (6MeMPR), have been x-irradiated and studied by electron spin resonance techniques at room temperature. Single crystals of 6MeMPR were also studied using electron nuclear double resonance techniques at room temperature and electron spin resonance at 90°K. Two distinct radical species were found in 6TG. Three distinct radical species were observed in 6MP. Seven distinct radical species were found in 6MeMP. Four distinct radical species were found in 6MeMPR. (ERB)

9439 GLC DETERMINATION OF CRUFOMATE (RUELENE) IN BOVINE BLOOD AND THE USE OF UV IRRADIATION AS A CONFIRMATORY TEST. Greenhalgh, R. (Chemistry and Biological Research Inst., Ottawa); Dokladalova, J.; Haufe, W. O. Bull. Environ. Contam. Toxicol.; 7: No. 4, 237-242(1972).

Extraction of bovine blood with chloroform and chromatography of the crude extracts gave a good recovery of crufomate at the 0.025 ppM level. The method compares well with the bioassay method. No neutral metabolites were found in the hexane or chloroform extracts of blood. Ultraviolet irradiation of crufomate results in the formation of a compound thought to be the des chloro derivative, this reaction provides a facile confirmatory test at the residue level. (auth)

9440 FURTHER STUDIES OF DNA DAMAGE AND LETHALITY FROM THE DECAY OF ^{125}I IN BACTERIOPHAGES. Krisch, R. E.; Sauri, C. J. (Argonne National Lab., IL). Int. J. Radiat. Biol.; 27: No. 6, 553-560(Jun 1975).

The DNA of coliphages T4 and T1 was labelled with ^{125}I-iododeoxyuridine. Iodine-125 decay is known to cause severe molecular damage via vacancy cascades (the Auger effect). We have compared the induction of both single- and double-strand breaks (SSBs and DSBs) in ^{125}I-labelled T4 DNA stored at −196°C during decay, either as intact phage or as free DNA. These comparative experiments indicated that, in addition to one DSB which apparently resulted directly from the Auger effect, each decay in an intact phage also gave rise to an additional 0.05 DSBs, as well as 1.6 SSBs, as a result of ionizing radiation absorbed in the same phage particles where the decay occurred. An examination of T4-killing by ^{125}I decay revealed a two-phase survival curve, whose initial slope corresponded to a lethal efficiency per ^{125}I decay of 0.95 ± 0.05, which was considerably higher than values previously determined. The results for phage T4, and of a more limited comparison of ^{125}I suicide and DNA damage in phage T1, support the hypothesis that the vacancy cascades which accompany each ^{125}I decay in DNA result in a double-strand break at the decay site and that each such break is a lethal event. (auth)

9441 OXYGEN-EFFECT ON STRAND BREAKS AND SPECIFIC END-GROUPS IN DNA OF IRRADIATED THYMOCYTES. Lennartz, M.; Coquerelle, T.; Bopp, A.; Hagen, U. (Kernforschungszentrum, Karlsruhe, Ger.). Int. J. Radiat. Biol.; 27: No. 6, 577-587(Jun 1975).

Thymocytes were irradiated with fast electrons up to 6 Mrad in the presence and absence of oxygen. The cells were treated before irradiation with a cold shock to prevent any repair reaction during irradiation. The DNA isolated subsequently was analyzed for double-strand breaks (dsb), actual single-strand breaks (ssb) and aklali-induced strand breaks (alisb). We observed a linear increase of all types of lesions with dose and an o.e.r. for dsb of 3.6, for ssb of 4.9 and for alisb of 2.1. The data do not deviate significantly from those, measured on thymocytes irradiated without cold shock. In DNA of irradiated thymocytes, the frequency of 3'- and 5'-hydroxyl and 5'-phosphate end-groups was analyzed enzymatically. In both the ssb and alisb, about 11% of the terminals carried 5'-OH end-groups and 20 to 40% 5'-phosphate groups. On the 3' terminals, 60 to 68% of the ssb were identified as 3'-OH end-groups, whereas on the alisb only a small amount of 3'-OH end-groups was found. The frequency of characterized end-groups showed the same oxygen effect as the corresponding strand breaks. Therefore, in the presence and absence of oxygen, the same mechanism may be responsible for formation of DNA strand breaks in vivo. (auth)

Radiation Effects on Cells

Refer also to abstracts 9487 and 9536.

9442 (CONF-750745-1) INTERACTIONS OF CARCINOGENS WITH HUMAN CELL DNA: DAMAGE AND REPAIR. Regan, J. D. (Oak Ridge National Lab., Tenn. (USA)). 1975. 18p. Dep. NTIS $4.00.

From satellite of IUPHAR congress; Turku, Finland (25 Jul 1975).

The DNA of human cells was exposed to UV radiation, gamma radiation, N-acetoxyacetoamino fluorene, 4-nitroquinoline oxide, ethyl methane sulfonate, propane sultone, and ICR-170. Following dBrVrd incubation and exposure to 313 nm radiation the number of strand breaks was recorded; the number of dBrVrd nucleotides inserted was also recorded. The significance of the results is discussed. (HLW)

9443 REJOINING OF DNA SINGLE-STRAND BREAKS IN MAMMALIAN CELLS INCUBATED IN BUFFER OR IN MEDIUM AFTER AEROBIC OR ANAEROBIC X IRRADIATION. Roots, R.; Smith, K. C. (Stanford Univ., CA). Int. J. Radiat. Biol.; 27: No. 6, 595-602(Jun 1975).

The capacity of Chinese hamster ovary cells to rejoin DNA single-strand breaks when incubated in either a buffered salt solution or culture medium has been studied after x irradiation under air and N_2. Molecular weights of DNA were determined by the sucrose-gradient centrifugation technique. The initial rate of rejoining was about the same for cells incubated in buffered salt solution or in growth-medium. After doses which resulted in approximately the same initial yield of breaks, i.e., 4.7 and 18.8 krad for air and N_2, respectively, the rate of rejoining of DNA single-strand breaks within the first 10 min of aerobic incubation was somewhat slower for cells irradiated under N_2 versus air. After the initial rapid rate of rejoining, a slower rejoining rate was discernible for medium-incubated calls. This slow process could not be studied for cells incubated in buffered salt solution due to buffer-induced DNA breakdown. The use of supra-lethal doses of ionizing radiation, required as a result of the lack of sensitivity of the alkaline sucrose-gradient technique for mammalian cells, is discussed, together with the fact that the disappearance of DNA single-strand breaks does not necessarily mean functional restoration of the irradiated DNA. (UK)

9444 COMPENSATION FOR SOLAR UV DAMAGE BY SOLAR RADIATION OF LONGER WAVELENGTHS. Smittia Spec., Chironomidae, Diptera. Kalthoff, K. (Freiburg Univ. (F. R. Germany). Inst. fuer Biologie 1). Oecologia (Berlin); 18: No. 2, 101-110 (1975).

3 figs.; 17 refs.

Photobiological experiments and laboratory observations on the egg deposition behavior of Smittia were undertaken to assess the effect of different spectral ranges of solar radiation on inactivation and photoreactivation of the eggs. The egg deposition of Smittia is not confined to certain periods of the daily cycle, nor are the eggs hidden away even from bright laboratory light. Both the egg shells and the jelly of the clusters absorb UV poorly. An action spectrum was established for inactivation of eggs by exposition to ultraviolet radiation during intravitelline cleavage. It shows a pronounced peak at 295 nm and overlaps with the spectrum of the sunlight between 300 and 310 nm wavelength. The inactivating range of solar UV was substituted for by 305 nm radiation of 5 nm band width and a dose rate of 0.28 W/m^2, obtained from a monochromator. This "solar UV equivalent" caused inactivation of 50% of exposed eggs within 12 min, whereas exposition to full overhead sunlight produced the same effect only within 3 hrs. It is concluded that the inactivating effect of solar UV (300-310 nm) is counteracted by repair mechanisms requiring light of longer wavelengths (320-480 nm) which are also emitted by the sun. The type of photoreactivation described is difficult to understand within the established framework of nucleic acid repair. However, it seems to play a vital role in the survival of Smittia eggs under sunlight without need for pigmentation or shading. (GE)

9445 PLOIDY EFFECT ON THE RADIATION REACTION OF MAMMALIAN CELLS. IV. Synchronized and Plateau-Phase Cells. Bauer, A.; Miltenburger, H. G. (Technische Univ. Darmstadt (F. R. Germany). Fachgebiet Zoologie). Humangenetik; 25: No. 3, 203-208(1974).

2 figs.; with refs.

The variation of x-ray sensitivity was investigated during the cell cycle. The cells were most sensitive during the S phase and less sensitive during the G_2 and G1 phase. Furthermore, the repair of x-ray damage was investigated in stationary (plateau phase) cells. The cells of both lines were able to repair damage to nearly the same extent. (auth)

9446 RADIOPROTECTIVE STEREOSTRUCTURE: ACTIVITY STUDY OF CIS- AND TRANS-2-MERCAPTOCYCLOBUTYLAMINE ANALOGS AND HOMOLOGS OF 2-MERCAPTOETHYLAMINE. Hart, R. W. (Ohio State Univ., Columbus); Gibson, R. E.; Chapman, J. D.; Reuvers, A. P.; Sinha, B. K.; Griffith, R. K.; Witiak, D. T. J. Med. Chem.; 18: No. 4, 323-331(Apr 1975).

For purposes of studying stereostructure-activity relationships at the molecular, cellular, and animal levels and probing the mechanism of 2-mercaptoethylamine (MEA) radioprotection we synthesized several conformationally constrained cyclobutyl analogs.

The comparative radioprotective properties for MEA, cis- and trans-2-mercaptocyclobutylamine (2), cis- and trans-2-mercaptocyclobutylmethylamine (3), and trans-2-mercaptomethylcyclobutylamine (4) are discussed in terms of their ability to chemically reduce transient free radicals, the formation of single strand breaks in DNA, and protect Chinese hamster cells (in vitro) and mice against the lethal effects of ionizing radiation. The results are interpreted in light of current proposed mechanisms of action for MEA. No correlation exists between ability of these analogs to enhance mice survival times and their ability to protect against the induction of DNA single strand breaks and the inactivation of proliferative capacity of hamster cells growing in vitro. Analysis of two isomers (cis- and trans-3) on the repair of single strand breaks showed both isomers only marginally influenced the rate and did not influence the extent of single strand break rejoining. The results are consistent with a mode of action involving chemical repair of transient radicals and protection against DNA and critical enzymatic sites. (auth)

Radiation Effects on Microorganisms

Refer also to abstracts 8952, 9429, and 9534–9536.

9447 (AECL-5254, pp 53-67) BIOLOGY BRANCH. Baldwin, W. F. Sep 1975.

In Biology and Health Physics Division progress report, April 1–June 30, 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Progress is reported on the following research projects in biochemistry and molecular biology: study of polypyrimidines in DNA from eukaryotes; radioinduced tumors in rats; radiosensitivity of Micrococcus radiodurans to ^{125}I; effects of uv radiation on the DNA-membrane complex from Escherichia coli; effects of x radiation on BUDR-substituted and on wild-type bacteriophage; ionizing radiation damage to bacterial cell walls; repair of DNA strand breaks in M. radiodurans; and absence of photoenzymatic repair in human diploid fibroblasts. Research projects in genetics, development and population studies included: polyacrylamide gel electrophoresis of intact bacteriophage T4 particles; mutants of bacteriophage T4 unable to grow on streptomycin resistant strains of E. coli; radiation genetics of Dablbominus; and radiation studies on biting flies. (HLW)

9448 MUTATION PRODUCTION IN ESCHERICHIA COLI K12 BY 5-BROMODEOXYURIDINE AND 313nm ULTRAVIOLET RADIATION. McCloskey, J. A. University Park, PA; Pennsylvania State Univ. (1974). 55p. University Microfilms Order No. 75-19,786.

Thesis (Ph. D.).

An Escherichia coli K12 strain, PS5, was grown in the presence and absence of 5-bromodeoxyuridine (BrdUrd), and irradiated with 313nM UV light. BrdUrd incorporation, as determined by cesium chloride equilibrium sedimentation, was approximately 44 percent. The production of revertants at two loci, purine$^-$/sub UAG/ and arginine$^-$/sub UAA/ were examined. BrdUrd alone produced mainly structural gene revertants at both loci. These revertants may be accounted for in terms of A:T yields G:C transitions in the DNA. Following 2×10^4 ergs/mm^2 at 313nm ultraviolet irradiation, suppressor mutations were produced at both loci, while the UAG structural gene revertants were destroyed. At the UAA locus, 313nm light produced some additional structural gene revertants. The destruction of the UAG structural gene revertants may be explainable in terms of the close relationship between the neighboring thymidine bases which could become substituted by BrdUrd. In BrdUrd-substituted cells, following irradiation at 313nm, up to 20 percent of the photoproducts have not been identified, and it is possible that one of these minor photoproducts is responsible for this destruction of UAG structural gene revertants. The production of suppressor mutations in BrdUrd-substituted cells following irradiation at 313nm is interesting. The suppressor mutations found in this study presumably arise from both transitions and transversions in the DNA. Therefore, BrdUrd plus 313nm light does not appear to be a specific mutagen. (Diss. Abstr. Int., B)

9449 NEAR ULTRAVIOLET INACTIVATION STUDIES ON ESCHERICHIA COLI TRYPTOPHANASE AND TRYPTOPHAN SYNTHETASE. Coetzee, W. F.; Pollard, E. C. (Pennsylvania State Univ., University Park). Photochem. Photobiol.; 22: No. 1-2, 29-32(Jul 1975).

The response of two pyridoxal-phosphate-requiring enzymes of E. coli, tryptophanase and tryptophan synthetase, to near uv light (320 to 400 nm) has been studied. Tryptophanase was inactivated both in vivo and in vitro, but tryptophan synthetase was resistant to near uv under both conditions. This showed that near uv inactivation is not general for pyridoxal-phosphate-requiring enzymes. Substrate protection against light inactivation was demonstrated for tryptophanase. It was furthermore shown that pyridoxal phosphate was required for inactivation of this enzyme. However, the action spectrum for this inactivation did not coincide with the absorption spectrum of tryptophanase or of pyridoxal phosphate. (auth)

9450 DOMINANT LETHAL MUTATIONS IN MALE MICE FED GAMMA-IRRADIATED DIET. Chauhan, P. S.; Aravindakshan, M.; Aiyer, A. S.; Sundaram, K. (Bhabha Atomic Research Centre, Bombay). Food Cosmet. Toxicol.; 13: No. 4, 433-436 (Aug 1975).

Three groups of Swiss male mice were fed a stock ration or an unirradiated or irradiated (2.5 Mrad) test diet for 8 wk. After the feeding period, the males were mated with groups of untreated female mice for 4 consecutive weeks. The females were autopsied at mid-term pregnancy for evaluation of dominant lethal mutations. Numbers of dead implantations, including deciduomas and dead embryos, showed no significant differences among the different groups, thus producing no evidence of any induced post-implantation lethality in mice fed on irradiated diet. Similarly, there was no indication of preimplantation lethality, since implantation rates remained comparable among different groups. Consumption of irradiated diet did not affect the fertility of mice. Total pre- and post-implantation loss, as indicated by the numbers of live implantations remained comparable among all the groups of mice. (auth)

9451 ESTIMATION OF RADIOLYTIC PRODUCTS AS A BASIS FOR EVALUATING THE WHOLESOMENESS OF IRRADIATED FOODS. Diehl, J. F.; Scherz, H. (Inst. of Radiation Tech., Karlsruhe, Ger.). Int. J. Appl. Radiat. Isot.; 26: No. 9, 499-507(Sep 1975).

In the past, the wholesomeness of irradiated foods has been judged almost exclusively on the basis of results obtained in animal feeding studies. Much information is now available concerning the qualitative and quantitative changes which occur in foodstuffs and in their constituents as a result of treatment with ionizing radiation. Utilizing such information, an approximate calculation of maximal chemical changes in an irradiated model food was attempted. It is suggested that future considerations of the legal acceptability of irradiated foods should take the results of chemical analyses and of such estimations into account. (auth)

9452 THIAMINE IN IRRADIATED FOODSTUFFS. II. Combined Effects of Irradiation, Storage, and Cooking on the Thiamine Content. Diehl, J. F. (Bundesforschungsanstalt fuer Ernaehrung Karlsruhe (F. R. Germany). Inst. fuer Strahlentechnologie). Z. Lebensm.-Untersuch.-Forsch.; 158: No. 2, 83-86(1975). (In German)

1 fig.; 15 refs.

The effects of 10 MeV electron radiation, of storage for several months and of heating on the thiamine content of wheat flour, crushed oats, ground pork, and dried whole egg were studied. A synergistic effect of these treatments on thiamine losses was observed. In irradiated samples thiamine content was more affected by storage and heating than in unirradiated ones. (auth)

9453 PRESENT STATUS OF RESEARCH WITHIN THE INTERNATIONAL PROJECT. Food Irradiat. Inf.; No. 4, 63-66(Mar 1975). (In English, French)

The short report enumerates the studies which are now completed by the International Project in the Field of Food Irradiation and the studies to be continued. New feeding studies with irradiated fish, rice, spices, and mangoes are performed. (GE)

9454 UNITED STATES OF AMERICA. Schulman, M. (USAEC Division of Biomedical and Environmental Research, Washington, D. C.). Food Irradiat. Inf.; No. 4, 44-57(Mar 1975).

67 refs.

A report is given of the activities of the USA in the field of food irradiation. The existing facilities and the dosimetric procedures are described including several new dosimeter systems. Chemical changes due to irradiation were studied in a lot of foodstuffs such as soybeans, shrimps, meat, and chicken-based pet food products as well as in model systems. Effects of irradiation on the content of Clostridium botulinum in foodstuffs were investigated. Studies in radicidation, radurization, and the combination of ionizing radiation with UV, heat, or microwave treatment were performed. Radiopreservation was studied in a lot of foodstuffs. Extensive feeding studies were performed in rats, mice, and dogs to assess the wholesomeness of irradiated beef, strawberries, and papayas. Furthermore, a short review is given of the present legislation and clearances and the economics. (GE)

9455 VENEZUELA. Revetti, L. M. (Instituto Venezolano de Investigaciones Cientificas, Caracas). Food Irradiat. Inf.; No. 4, 61-62(Mar 1975).

7 refs.

A food irradiation program has recently been started in Venezuela. Radiation disinfestation of black beans and corn was studied as well as sprout inhibition of onions and radiation preservation of pepper, tomatoes, and papayas. Studies have begun on radiopreservation of potatoes. (GE)

9456 UNITED KINGDOM. Goodman, R. E. J. (Ministry of Agriculture, Fisheries and Food, London (UK)). Food Irradiat. Inf.; No. 4, 42-43(Mar 1975).

2 refs.

The present activities of the UK in the field of food irradiation are restricted to studies in radiation microbiology. The effects of heat and irradiation on Clostridium botulinum and Staphylococcus aureus were studied. (GE)

9457 PHILIPPINES. Gonzales, O. N. (National Inst. of Science and Technology, Manila (Philippines)). Food Irradiat. Inf.; No. 4, 34-37(Mar 1975).

A short report is given of the present activities of the Philippines in the field of food irradiation. Irradiation is done with a ^{60}Co gamma source. Microbial survival after radurization of fish, grain, and fruits was studied as well as radiation-induced inactivation of toxins e.g. aflatoxin. The response of some insect pests commonly infesting stored products to gamma irradiation was investigated. Furthermore, radiopreservation of potatoes, other vegetables and spices, fruits, poultry, and egg products was studied. (GE)

9458 NORWAY. Underdal, B. (Veterinary Coll. of Norway, Oslo. Dept. of Food Hygiene). Food Irradiat. Inf.; No. 4, 33(Mar 1975).

A short report is given of the activities of Norway in the field of food irradiation. Experiments were performed with a ^{60}Co γ-source of 30,000 Ci. The chemical changes induced by irradiation were studied in fish and spices. Radiation microbiology studies were dealing with the effect of γ radiation on Salmonella Senftenberg in solutions and herring meal. (GE)

9459 JAPAN. Matsui, T. (Atomic Energy Commission, Tokyo (Japan). Atomic Energy Bureau). Food Irradiat. Inf.; No. 4, 23-32(Mar 1975).

A report is given on the basic research and development in food irradiation in Japan. Two new irradiation facilities are extensively described. Basic research is performed in radiation chemistry of fruits, potatoes, fish products, meat products, and model systems. Microbiological research is concerned with Clostridium botulinum and radicidation and radurization studies, as well as effects of combination treatment on Micrococcus radiodurans. Radiation treatment of grain, fruits, vegetables, potatoes, fish, meat and meat products, and other commodities is performed. Wholesomeness studies are dealing with the nutritional value and animal feeding studies are carried out with irradiated potatoes, onions, rice, wheat, and sausages. Two short chapters are concerned with legislation and marketing. (GE)

9460 ITALY. Guerrieri, G. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Settore Radiazioni). Food Irradiat. Inf.; No. 4, 19-22(Mar 1975).

The activities of Italy in the field of food irradiation are described. The radiation sources used are ^{60}Co gamma sources. Chemical changes due to irradiation were studied in potatoes, fruits, fish, meat and meat products, and animal feeds. Radiation effects on microbial content of fish, egg products, and fruits were also investigated. A study was made of the suitability of potatoes, irradiated or treated chemically, for chip production. Wholesomeness studies of irradiated diet were performed in mice. (GE)

9461 HUNGARY. Farkas, J. (Kozponti Elelmiszeripari Kutato Intezet, Budapest (Hungary)). Food Irradiat. Inf.; No. 4, 11-18(Mar 1975).

39 refs.

A report is given of the activities of Hungary in the field of food irradiation. Two new radiation sources were installed at the Central Food Research Institute, Budapest in 1971. A lot of work was done in the field of radiation chemistry, radiation microbiology (radurization of spices and wine, combination treatment of meat products and fruits) and radiation treatment of various commodities such as spices, vegetables, fruits, and fruit juices. Wholesomeness studies of irradiated standard diet and spices were performed in rats. A short review is given of the present status of legislation and marketing. (GE)

9462 BUREAU EURISOTOP. Proepsti, G. (Commission of the European Communities, Brussels (Belgium). Bureau Eurisotop). Food Irradiat. Inf.; No. 4, 8-10(Mar 1975).

8 refs.

A report is given of the activities of the Bureau Eurisotop in the field of food irradiation. The main subjects are studies of sprout inhibition of potatoes, radurization of shrimps and radicidation of egg products. The legal aspects of marketing of irradiated foodstuffs are discussed with representatives of the member states. (GE)

9463 BANGLADESH. Faizur Rahman, A. T. M. (Atomic Energy Centre, Dacca (Bangladesh). Radiobiology Div.). Food Irradiat. Inf.; No. 4, 6-7(Mar 1975).

A review is given on the activities of the laboratories of the Atomic Energy Centre, Dacca in the field of food irradiation. A ^{60}Co gamma source was used for these studies. The effects of irradiation on rice grains and rice starch is investigated as well as the radurization of fish, the extension of shelf-life of fresh mango juice by combined heat and irradiation treatment, and inhibition of sprouting of potatoes by irradiation. (GE)

9464 CHANGE OF MICROFLORA OF TWO STARCH SAMPLES BY GAMMA IRRADIATION. Fretton, R.; Fretton, J.; Delattre, J. M. (CEA Centre d'Etudes Nucleaires de Cadarache, 13- Saint-Paul-les-Durance (France). Service de Radio-Agronomie); Beerens, H. (Centre d'Etudes et de Recherches Technologiques des Industries Alimentaires (CERTIA), 59- Villeneuve d'Ascq (France)). Staerke; 27: No. 1, 4-9(Jan 1975). (In French).

4 figs.; 4 tabs.; 17 refs.

Starch is the basic component of a larger number of manufactured foods. The disinfection of such a powder by ^{60}Co is studied here. Gamma irradiation of two starch samples with different degrees of contamination allows the assumption that, in most cases, good radiopasteurization can be achieved with 300 krad. The radiopasteurization doses (varying from 300 to 600 krad) are a function of the initial contamination. Irradiation effects are spectacular with molds. Activation of spores of some Clostridium species leads us to recommend an irradiation level higher than 200 krad. The most resistant organisms to gamma irradiation are the aerobic and anaerobic sporulated bacteria. The thermophilic forms are the most important. Spores of Bacillus, chiefly Bacillus licheniformis and Bacillus brevis, are the most frequent bacteria. Storage of irradiated starch at room temperature has little effect upon the number of revivable survivors. (auth)

9465 SURVEYS ON RADIATION-RESISTANT ASPOROGENIC BACTERIA IN NATURAL ENVIRONMENTS. Yano, K.; Cho, B.; Yoshinaka, T.; Yamaguchi, H. (Tokyo Univ.). pp 85-98 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Surveys on aerobic asporogenic radiation-resistant bacteria in the natural environment have been carried out in Japan with more than 200 samples, including rice, feces of some animals, and also water, mud and soil from areas both specific and non-specific for radiation collected from open spaces, rivers and ponds, etc., both urban and rural, polluted and unpolluted. Non-sporeforming surviving bacteria after gamma irradiation at a dose of 8.1×10^5 rad were colored yellow, pink to red. Spore-formers only were obtained from soil. Originally survivors were often found in samples of aqueous origin. Apart from Pseudomonas radiora isolated from rice grains, all were Gram positive. An isolate similar to Micrococcus radiodurans was obtained from puddle water in an area that was non-specific for radiation. Arthrobacter radiotolerans isolated from the well at Misasa, which is a well-known radon-containing hot spring, showed the highest resistance so far known with a shoulder dose and D_0 value of 6×10^5 and 1×10^6 rad respectively. It is noteworthy that samples from the wells at Misasa always exhibited high and/or extremely high resistants, and another well also exhibited a high resistant from time to time. It is possible that such strains may be encouraged by the environmental conditions, but their slow growth and the predominance of other strains make their isolation difficult without using radiation. Some ecological aspects and the incidence of resistants in specific areas are discussed. (auth)

9466 VIRUSES AND IONIZING RADIATION IN RESPECT TO WASTE-WATER TREATMENT. Lemke, H. S.; Sinskey, A. J. (Massachusetts Inst. of Tech., Cambridge). pp 99-120 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

After a short survey of viruses and the diseases they can cause in man, the effects of ionizing radiation on viruses are discussed. Ionizing radiation inactivation viruses by direct and indirect effects, and it is well established that the radiosensitive target is the nucleic acid. Factors affecting the radiosensitivity are tem-

perature and suspending menstruum. The possible influence of oxygen on viral radiosensitization remains unclear. For the effective application of radiation treatment on waste-waters information is required concerning the concentration of viruses in waste-waters so that treatment doses may be determined. (auth)

9467 SANITARY EFFECT OF GAMMA IRRADIATION ON SEWAGE SLUDGE. Hess, E.; Breer, C. (Univ., Zurich). pp 203-208 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Our investigations prove that sludge contains Salmonellae in more than 90% of samples. The maximum number of organisms was 10^7 per liter. One of our most important findings was the fact that neither aerobic stabilization nor anaerobic digestion significantly reduces contamination with Salmonellae. Moreover we found that Salmonellae in sewage sludge spread on grass may survive up to 72 weeks. Fertilizing with unsanitized sludge may therefore lead to transmission from plant to animal. The increasing number of Salmonella carriers among our herds of cattle and their striking accumulation during the grazing period demonstrate that such transmission represents a growing danger. Sanitation of sludge to be used as fertilizer is therefore urgent. In our investigation of the sanitary effect of pasteurization (70°C for 30 min) and of gamma irradiation on sewage sludge, we examined the number of Enterobacteriaceae before and after irradiation in 259 specimens of sludge from 44 different sewage disposal plants. The doses applied were 100, 200, 300, 400 and also 500 krad. We found a linear reduction of Enterobacteriaceae with increasing doses; a dose of 300 krad resulted in a death rate of 10^4 to 10^6, occasionally 10^9 Enterobacteriaceae; and there were less than 10 Enterobacteriaceae per gram in 97.2% of the samples irradiated with 300 krad. The results of these model experiments could be completely confirmed under practical conditions in the irradiation plant of Geiselbullach. The sanitary effect of gamma irradiation with 300 to 350 krad, determined by the reduction in Enterobacteriaceae, was equivalent to the effect of heat treatment by pasteurization. (auth)

9468 EXPERIENCE WITH A PILOT PLANT FOR THE IRRADIATION OF SEWAGE SLUDGE: BACTERIOLOGICAL AND PARASITOLOGICAL STUDIES AFTER IRRADIATION. Wizigmann, I. (Institut fuer Angewandt Hygiene, Munich); Wuersching, F. pp 477-484 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Comparative bacteriological studies of sewage sludge in a sewage plant have demonstrated that mechanical-biological sewage treatment reduced the total bacterial count and those of Enterococces by 2 log and the Enterobacteriaceae by 3 to 4 log. Frequently Salmonella could be isolated from sewage sludge. A further reduction of viable microorganisms could be achieved by irradiation of sewage sludge (^{60}Co, gamma-radiation, 260 krad, 210 min). This reduction amounted to an average of 2 log with Enterococces and total bacterial count, and to 5 log with Enterobacteriaceae. Out of 40 samples investigated after irradiation, two contained Salmonella. The hygienic effects of the irradiation unit were demonstrated by means of a model experiment with bacterial pure cultures. Microorganisms of different species as well as strains of the same species differ in their sensitivity to irradiation. Parasitological experiments with eggs of Ascaris suum were carried out to test the inhibitory or killing ability of the gamma rays on the developing stages of parasites. (auth)

9469 EXPERIENCE WITH A PILOT PLANT FOR THE IRRADIATION OF SEWAGE SLUDGE: EXPERIMENTS ON THE INACTIVATION OF VIRUSES IN SEWAGE SLUDGE AFTER RADIATION TREATMENT. Epp, C. (Landesuntersuchungsamt fuer das Gesundheitswesen Sudbayen, Munich). pp 485-490 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STI/PUB-402; CONF-750316-.

Investigations examining the virus inactivating effect of a ^{60}Co-plant have up to now been limited to attempts to isolate virus from sludge samples taken from sewage sludge before and after irradiation with 300 krad. As in these sludge samples the presence of virus could be proved only on a rather irregular basis, an experiment was carried out in which defined virus quantities were packed into capsules and mixed with the digested sludge. At the end of the hygienization process these capsules were removed from the sludge and examined for virus content. In addition one radiation volume (5.6 m^3) was infected with attenuated polio virus type I and the virus content of the sludge titrated before and after the radiation treatment. (auth)

9470 EXPERIENCE WITH A PILOT PLANT FOR THE IRRADIATION OF SEWAGE SLUDGE: RESULTS ON THE EFFECT OF DIFFERENTLY TREATED SEWAGE SLUDGE ON PLANTS AND SOIL. Suess, A.; Rosopulo, A.; Borchert, H.; Beck, T.; Bauchhenss, J.; Schurmann, G. (Bayerische Landesanstalt fuer Bodenkultur und Pflanzenbav, Munich). pp 503-533 of Radiation for a Clean Environment. Vienna; International Atomic Energy Agency (1975).

From symposium on the use of high level radiation in waste treatment status and prospects; Munich, F.R. Germany (17 Mar 1975). See STU/PUB-402; CONF-750316-.

Since hygienization of sewage sludge will be important for an agricultural application it is necessary to study the effect of differently treated sewage sludge on plants and soil. In bean and maize experiments in 1973 and 1974 it was found that the treatment of sewage sludge is less important than soil properties and water capacity. Analysis on the efficiency of nutrients, minor elements and heavy metals from differently treated sewage sludge to plants were performed. Microbiological greenhouse studies indicated that there is a distinct tendency for different reactions, that irradiated sewage sludge gives a slightly better effect than untreated sludge, while the heat-treated sewage sludge indicates always a decrease, especially with the increase of applied amounts (respiration, protease and nitrification). In the field experiments there were almost no differences between untreated and irradiated sewage sludge, whereas there was always a smaller microbial activity after application of heat-treated sewage sludge. Studies on soil fauna (especially on Collemboles and Oribatidae) in the field trials indicate the influences of abiotic factors on the different locations. Besides these influences there was a decrease in the number of Collemboles and mites (in comparison with a normal fertilized plot) on the plots with 800 m^3/ha treated sewage sludge. There was a remarkably large decrease in the plots with irradiated sewage sludge after an application of 800 m^3/ha. Depending on the soil type, physical and chemical studies indicated an increase in the effective field capacity after the application of sewage sludge, and sometimes the best effects occurred with irradiated sewage sludge. Relative high aggregate values were observed (6-2, 6-5 mm diameter) in the plots with irradiated sewage sludge. (auth)

9471 GAMMA RADIATION STERILIZATION. Basson, R. A. S. Afr. Nurs. J.; 42: No. 2, 27-28(Feb 1975).

The growth in the use of gamma radiation for the sterilization of medical supplies on a world wide basis over the past 20 years is discussed. The factors contributing to this growth are outlined. (ERB)

9472 ULTRAVIOLET IRRADIATION AS A METHOD OF WATER STERILIZATION: OUR PERSONAL EXPERIENCE. Sanchez-Buenaventura, J.; Navarro, J. F. M.; Sabater, J. G. (Univ., Valencia). Rev. Sanid. Hig. Publica; 46: 293-299(Apr 1972). (In Spanish)

In order to know the bactericidal effects of ultraviolet rays, an automatic unity (based on the principle of the electromagnetic action of uv rays for sterilization of liquids) was tested. Spring water was contaminated at different known concentrations. After irradiation water samples were analyzed. The depuration system revealed as satisfactory and better than other methods because permanent service is not necessary, there is no contact with the liquid to be sterilized and no physical nor chemical modification of it is achieved. (auth)

9473 INVESTIGATION OF STERILITY OF SELECTED PHARMACEUTICAL RAW MATERIALS. Wozniak, W.; Szepietowska, B.; Zagorski, Z. P. (Inst. of Drug Research and Control, Warsaw). Acta Pol. Pharm.; 29: No. 6, 638-648(1972).

The efficacy of sterilization by irradiation has been tested for the case of selected pharmaceutical raw materials of animal origin. A similar investigation has been carried out on the thermal sterilization of chemical raw materials. The results show that both the methods give positive results causing a considerable decrease in the final microbiological contamination level of manufactured drugs. (auth)

Radiation Effects on Plants

Refer also to abstract 9535.

9474 (CENA-BC-020) EFFECTS OF GAMMA RADIATION X CYSTEINE INTERACTION IN PEA SEEDLINGS (PISUM SATIVUM L.). Gusman, A. B.; Crocomo, O. J. (Centro de Energia

Nuclear na Agricultura, Piracicaba (Brazil)). Jul 1974. 24p. (In Portuguese). INIS.

The aim of this work was to study the combined biological effects of two doses of gamma radiation (5 and 35 krad) and 10-3M cysteine concentration on peroxidase activity, and the morphology transverse sections of stem tissue of Pea seedlings (Pisum sativum L., var. Perfectah-IAC-170). The measurements were made during 3 days at intervals of 12 hours after irradiation and soaking of the seeds. The seeds received the following treatments: R (control) R + C (without radiation and cysteine present); R_1 (radiation dose-5 krad); R_1 + C (radiation and cysteine combined); R_2 (radiation dose-35 krad); R_2 + C (radiation and cysteine combined). The data suggest that the dose of 5 krad induced a dual effect on the peroxidase activity which decreased in the first 12 hours, increased between 24 and 36 hours, and then decreased again between 48 and 72 hours, in relation to the control. On the other hand, the peroxidase activity decreased throughout the experiment, when a dose of 35 krad was applied. The combination of radiation and cysteine showed a statistically significant interaction. When combined, there was a tendency to diminish the effects of radiation and cysteine alone, as measured by the activity of peroxidase, and morphology in transverse sections. Cysteine alone was just as effective as the two irradiation doses. Cysteine induced an increase in the area of the stele, while in combination with radiation (R × C) brought about its reduction. (INIS)

9475 QUANTITATIVE DOSE-RESPONSE OF GROWTH AND DEVELOPMENT IN ARABIDOPSIS THALIANA EXPOSED TO CHRONIC GAMMA RADIATION. Daly, K. (California State Univ., Northridge); Thompson, K. H. Int. J. Radiat. Biol.; 28: No. 1, 61-66(Jul 1975).

The response of Arabidopsis thaliana (L.) Heynh. (Cruciferae) to a gradient of chronic gamma radiation was examined under field conditions. Plants that were initially introduced to the gamma field as dry seeds received exposures of 1.34 to 18,800 R/20 hour day from the time of seed germination. Regression analysis demonstrated a significant, but nonlinear, response for three variables, number of seedlings emerging, number of plants flowering, and plant volume; the response of a fourth variable, number of leaves per plant, was not related to daily exposure. The LD_{50} values ranged from 66 R/20 hour day for plant volume to 1231 R/20 hour day for seedling emergence. Flowering and plant volume were the most sensitive indicators of radiation exposure. The demonstration of a variable threshold at low levels of exposure indicates that in nature A. thaliana may be exposed to environmental radiation throughout its life-cycle without significant modification of growth or development. (auth)

9476 MODIFICATION OF THE RADIOSENSITIVITY OF BARLEY SEED BY POST-TREATMENT WITH CAFFEINE. II. Kinetics of Decay of Caffeine-Reactive Oxygen-Sensitive Sites. Nadkarni, S.; Kesavan, P. C. (Jawaharlal Nehru Univ., New Delhi). Int. J. Radiat. Biol.; 27: No. 6, 569-576(Jun 1975).

In dry barley seeds (3.1 per cent moisture content), the maximal level of oxic damage (class III damage) was reached within the first 40 min of post-hydration in oxygenated water at 5 ± 1°C. The decay of the gamma-ray-induced oxygen sensitive sites required however, about 120 min. The mechanisms leading to partial protection against the class III damage were initiated when caffeine was present during the first 30 min of oxygenated post-hydration. If added after 30 min of oxygenated hydration, caffeine had no protective action. For the potentiation of an oxygen-independent component of damage, caffeine had to be present during the first 240 min of oxygen-free hydration. These observations involving a physiologically inert system raised questions regarding physico-chemical vis-a-vis biochemical mechanisms of caffeine effect on irradiated systems and these have been briefly discussed. (auth)

9477 LACK OF RADIOSENSITIZING EFFECT OF EXTRACT FROM GERMINATING BARLEY SEEDS. Balachandran, R.; Ahmad, A.; Kesavan, P. C. (Jawaharlal Nehru Univ., New Delhi). Int. J. Radiat. Biol.; 27: No. 6, 607-610(Jun 1975).

An extract of germinating barley seeds has been reported as having a radiosensitizing effect on barley seeds (Sharma, B., 1970, Int. J. Radiat. Biol., 17, 15). An attempt has been made to repeat this work, and extend it to include an additional treatment with irradiated (45 krad) extract. Seeds of hull-less barley (variety IB 65) were pre-treated and then exposed in air at room temperature 25 ± 1°C to total doses of 10, 20, 30, and 40 krad of gamma radiation at a dose-rate of 136 rad/sec. Shoot-tips after 7 days growth were examined for anaphase bridges and acentric fragments by Feulgen technique. In addition, seedling growth was measured after 7 days, and the chlorophyll mutation level in the M_2 population was also determined. The only observed significant effect ($p \leq 0.05$) was for M_2 chlorophyll mutants induced by 10 krad in the presence of irradiated extract. All other comparisons gave no evidence of any potentiating effect, and the results do not therefore support the assumption that any radiosensitization occurs. The small degree of radiosensitizing effect of irradiated (45 krad) extract could be due to the formation of radiolytic substances with slight radiosensitizing effects on seeds subsequently irradiated with 10 krad of gamma rays. The cause of the discrepancy with Sharma's work is not certain, but could be due to differences in the varieties tested and the dose-rates. (UK)

9478 INVESTIGATION OF THE ACCEPTOR ACTIVITY AND HETEROGENEITY OF SOME TRNA IN A RADIOMUTANT OF COTTON. Ibragimov, A. P.; Tuichibaev, M. U.; Karakuziev, T. U. (Inst. of Biochemistry, Tashkent). Biokhimiya; 38: No. 2, 412-416(1973). (In Russian)

As evidenced from investigation of the acceptor activity of some tRNA isolated from 2-day-old cotton seedlings of the strain 108-F and of its radiomutant, lysil- and especially phenylalanyl-tRNA possess a low activity in the reaction of aminoacylation in the radiomutant compared with those of the initial strain. Fractionation of ^{14}C-aminoacyl-tRNA on MAC columns evidenced that tRNA specific to valine and tyrosine are represented by two isoacceptor forms and lysil- and phenylalanyl-tRNA, by three isoacceptor forms, both in the initial strain and in the radiomutant. In the radiomutant, the amount of the first isoacceptor form of the phenylalanyl-tRNA is increased while the third, in contrast, decreases compared to the initial strain 108-F. Acceptor activity of all three isoacceptor forms of lysyl-tRNA in ratiomutant is somewhat lower than in the strain 108-F. Cross-reactions between tRNA and aminoacyl-tRNA-synthetases and fractionation of the ^{14}C-phenylalanyl-tRNA complexes on the MAC columns indicated a dependence of a low rate of acylation of phenyl-tRNA-III on the activity of the respective enzyme—phenylalyl-tRNA-synthetase. (auth)

Radiation Effects on Animals

Man

Refer also to abstracts 9993, 11069, 11072, 11080, 11087, and 11351.

9479 (AECL-5254) BIOLOGY AND HEALTH PHYSICS DIVISION PROGRESS REPORT, APRIL 1-JUNE 30, 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sep 1975. 70p. Dep. NTIS (US Sales Only) $5.50. AECL $1.50.

Separate abstracts were prepared for the four sections of the report. (HLW)

For abstracts of individual sections see: 9256, 9447, 9480, and 9533.

9480 (AECL-5254, pp 7-24) HEALTH PHYSICS BRANCH. Cowper, G. Sep 1975.

In Biology and Health Physics Division progress report, April 1-June 30, 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Progress is reported on research in fast neutron dosimetry, thermoluminescence dosimetry, calibration of Ionex chambers, environmental gamma monitoring, safeguards instrumentation, radiation monitoring instruments, tritium monitoring, atmospheric diffusion studies, and routine dose monitoring. (HLW)

9481 (CONF-751135-1) RATIONAL APPROACH TO PATIENT EXPOSURE TO RADIATION IN THE HOSPITAL. Lanzl, L. H.; Moser, F. L. (Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). 1975. Contract E(11-1)-69. 11p. Dep. NTIS $4.50.

From conference on personnel and patient radiation exposure and control in medical facilities; Chicago, Illinois, USA (16 Nov 1975).

During radiotherapy for the treatment of neoplasms the radiation dose needs to be selected with great care and the treatment needs to be carried out with a high degree of precision and accuracy for maximum results. Data are presented on the probability of tumor control of Hodgkin's disease and carcinoma of the supraglottis following radiation treatment. The x radiation dose to patients during various diagnostic radiographic examinations is discussed and several methods are suggested for dose reduction. (CH)

9482 (EPA-520/7-75-014) EPA REVIEW OF RADIATION PROTECTION ACTIVITIES, 1974. (Environmental Protection Agency, Washington, D. C. (USA). Office of Radiation Programs). Sep 1975. 114p. U. S. Environmental Protection Agency, Washington, DC.

Activities of the Environmental Protection Agency Office of Radiation Programs during 1974 are summarized. Emphasis was

placed on the implementation of a program leading to the establishment of necessary radiation controls for protection of public health and the environment. (CH)

9483 (JPRS-65988) SPACE BIOLOGY AND AEROSPACE MEDICINE. Translation of Kosm. Biol. Aviakosmicheskaya Med.; 9: No. 4, (1975). 154p. NTIS

The report contains articles concerning the selection and training of cosmonauts; evaluation and analysis of accumulated data to facilitate the on-going transition from orbital to interplanetary flights; research aimed at guaranteeing safety on long flights and reliability of the human component of the man-spaceship system; space psychology and physiology; environmental problems and control (spacecraft habitability, effects of radiation and weightlessness, etc.); and telemetry. Separate abstracts were prepared for 4 sections. (auth)

For abstracts of individual sections see: 9423 and 9484–9486.

9484 (JPRS-65988, pp 69-79) OPTICAL EFFECTS WITH EXPOSURE OF THE EYES TO COSMIC RAYS. Grigor'ev, Yu. G.; Demirchoglyan, G. G. 22 Oct 1975. Translated from Kosm. Biol. Aviakosmicheskaya Med.; 9: No. 4, 46-53(1975).

In Space Biology and Aerospace Medicine.

Radiobiological investigations of the eye are reviewed. Some topics include: effects of x and γ radiation on the retina; effects of electron beams on insect eyes; effects of cosmic radiation on the eyes of astronauts and optical phosphenes; and optical flashes in eyes of astronauts. (HLW)

9485 (JPRS-65988, pp 113-119) ANALYSIS OF THE THICKNESS OF SHIELDING OF A RADIATION REFUGE DURING PROLONGED SPACE FLIGHTS. Dudkin, V. E.; Kovalev, E. E.; Kolomenskii, A. V.; Smirennii, L. N.; Sakovich, V. A. 22 Oct 1975. Translated from Kosm. Biol. Aviakosmicheskaya Med.; 9: No. 4, 72-74(1975).

In Space Biology and Aerospace Medicine.

Methods and results of computations of the thickness of shielding of a radiation shelter for different variants of a prolonged space flight are described. Variants include flights with a duration of 100 to 1,000 days during the period of maximum solar activity and during the period of its minimum. Results of computations of protection of a radiation refuge for ships with liquid jet engines were compared with a nuclear power plant. (HLW)

9486 (JPRS-65988, pp 120-126) METHOD FOR COMPUTING THE THICKNESS OF TISSUE IN DETERMINING DEEP DOSES IN A PHANTOM-DUMMY. Smirennii, L. N.; Khortsev, A. V. 22 Oct 1975. Translated from Kosm. Biol. Aviakosmicheskaya Med.; 9: No. 4, 75-78(1975).

In Space Biology and Aerospace Medicine.

The importance of data on spatial distribution of absorbed doses in the body is emphasized. The use of geometrical forms for estimating doses is described. A method was developed for calculating thicknesses using the coordinate of points on the body surface with the use of an electronic computer. In carrying out calculations the body is represented in the form of a set of points M whose boundary is determined using the coordinates of surface points. The method makes it possible to calculate the distribution of thicknesses at any point with any relative arrangement of parts of the body and to compute the dose intensity at that point. (HLW)

9487 (LA-UR-75-2259) PION RADIATION THERAPY. Kligerman, M. M. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 13p. (CONF-751060-3). Dep. NTIS $3.50.

From international particle radiation therapy workshop; Key Biscayne, Florida, USA (1 Oct 1975).

Results are summarized from studies on the relative biological effects as compared with x or gamma radiation and OER of negative pi mesons produced by the Berkeley 184-inch synchrocyclotron or the NIMROD 7-GeV proton synchrocyclotron at the Rutherford High Energy Laboratory in England using cultured animal cells or Vicia faba cells as the test system. Preliminary results are reported from similar radiobiological studies at the Los Alamos Meson Physics Facility. The relative response of human tissues to peak pion irradiation was compared with 140 kV x rays in a single patient with multiple malignant melanoma by observing the acute response of the skin surrounding metastatic modules following exposure to either pions or x radiation. Color photographs of the irradiated areas made at least twice weekly and densitometry measurements and observations by radiation therapists indicated that maximum erythemia occurred during the fifth, sixth, or seventh week after the start of a schedule of fractionated exposure to 15 fractions over 19 elapsed days. X irradiation was delivered at a dose rate of 500 rads/min to modules to deliver 55, 66, or 75 percent of a skin surface dose of 5,200 rads and pion irradiation, at doses numerically 50 percent of the x ray dose, was delivered at a dose rate of 5 to 7 rads/min. Dose response curves were plotted. Results of histological examinations of skin samples taken 24 weeks following irradiation are reported. Results are discussed relative to the destruction of melanoma cells following pion or x rav treatment. (CH)

9488 (NASA-TT-F-791) EFFECT OF EXTREME FACTORS ON THE STRUCTURE OF THE ORGANS AND TISSUES. Prives, M. G.; Mikhaylov, S. S. (eds.). Feb 1975. Translation of Vliyaniye Ekstremal'nykh Faktorov na Stroyeniye Organov i Tkaney, Moscow, Meditsina Press, 1972. (N-75-17057). 91p. NTIS $4.75.

This book is a collection of papers delivered by Soviet anatomists at a symposium (the Ninth International Congress of Anatomists in Leningrad, 1970) devoted to a study of the influence of extreme factors of high-altitude and spaceflights on the structure of the organism. The papers in this collection present data on the influence exerted on the structure of the organism by g-forces, hypokinesia and hypodynamia as well as radiation. The solution of these problems constitutes the task of a new branch of anatomy which is a part of aviation and space biology and medicine. The book is intended for anatomists, histologists, pathological anatomists and biologists. Abstracts of individual papers are included at the end of this book. (auth)

9489 (NUREG-75/108) SEVENTH ANNUAL OCCUPATIONAL RADIATION EXPOSURE REPORT, 1974. Brooks, B. G. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Nuclear Reactor Regulation). Nov 1975. 14p. NTIS $3.50.

This is a report by the U.S. Nuclear Regulatory Commission on the operation of the former Atomic Energy Commission's centralized repository of personnel occupational radiation exposure information for Calendar Year 1974. The bulk of the information was obtained from annual and termination reports submitted by certain types of AEC licensees (i.e., operating nuclear power reactors; industrial radiographers; fuel processors, fabricators, and reprocessors; commercial processors and distributors of specified quantities of byproduct materials) pursuant to Part 20.407 and Part 20.408 of Title 10, Chapter 1, Code of Federal Regulations, respectively. Annual reports were received from 421 covered licensees indicating that 85,097 individuals were monitored for exposure to radiation during 1974 and some 17,627 individuals terminated their employment or work assignment with covered licensees in 1974. Both figures show an increase of about 23% over those reported for 1973. Information on incidents involving personnel overexposures to radiation or radioactive materials is obtained from reports required to be submitted by all AEC licensees pursuant to Parts 20.4C3 and 20.405 of Title 10, Chapter 1, Code of Federal Regulations. The number of the more significant personnel overexposures, defined in Part 20.403, has remained fairly constant over the past seven years despite an increase in the number of individuals being monitored. (auth)

9490 (ORNL-4888) STRATEGIC CONSIDERATIONS IN PLANNING A COUNTEREVACUATION. Chester, C. V.; Cristy, G. A.; Haaland, C. M. (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 102p. Dep. NTIS $5.45.

The Soviet Union has highly developed plans to evacuate their population centers in a nuclear confrontation. Their plans include construction of expedient shelters in the outlying areas and continued operation of their essential industry by commuting workers. If they should successfully implement their plan, a subsequent nuclear exchange with the United States would cost them far fewer casualties than they suffered in World War II. Without a corresponding evacuation, the US could lose from 50 to 70 percent of its population. This asymmetry in vulnerability, if allowed to persist, would seriously weaken the bargaining position of the US President. To restore the balance, a great reduction in vulnerability can be achieved most economically by planning a US counterevacuation as a response to a Soviet evacuation. Russian historical experience with murderous invaders, most recently in World War II, has made authoritarian defense measures involving civilians and property in peacetime quite acceptable in their culture. In the US, wide-scale use of private property and civilian participation in defense activity are not feasible until the development of a grave crisis. Hence US evacuation plans must differ in several important respects from the Soviet plans. However, this preliminary study indicates that the US has ample material resources to move and shelter its population at least as effectively as the Soviet Union. Perhaps the most critical disadvantage of the US is in morale, as evidenced by the widespread misconception that effective survival measures are not possible. (auth)

9491 (UCRL-77092) SIMPLIFIED SCHEME OR RADIOACTIVE PLUME CALCULATIONS. Gibson, T. A.; Montan, D. N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Nov 1976. Contract W-7405-Eng-48. 7p. (CONF-760202-11). Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

A simplified mathematical scheme to estimate external whole-body gamma radiation exposure rates from gaseous radioactive plumes was developed for the Rio Blanco Gas Field Nuclear Stimulation Experiment. The method enables one to calculate swiftly, in the field, downwind exposure rates knowing the meteorological conditions and gamma radiation exposure rates measured by detectors positioned near the plume source. The method is straightforward and easy to use under field conditions without the help of mini-computers. It is applicable to a wide range of radioactive plume situations. It should be noted that the Rio Blanco experiment was detonated on May 17, 1973, and no seep or release of radioactive material occurred. (auth)

9492 TRITIUM HAZARDS CONNECTED WITH THE OPERATION OF A NEUTRON GENERATOR. Kollar, J.; Tatara, M.; Chorvat, D. (Vyskumny Ustov Hygieny Prace a Chork z Povolania, Bratislava). Int. J. Appl. Radiat. Isot.; 26: No. 10, 635-636(Oct 1975).

The tritium hazards in a laboratory of the Physics Institute of the Slovak Academy of Sciences which operates a home-made neutron generator has been studied. Long term investigations were made by measuring tritium concentrations released from tritium targets and their metal foil wrappings in the working atmosphere (HTO, T-aerosol), on surfaces (wipe tests, fall out activities) and in pump oils. Biological monitoring was undertaken of operating personnel. The presented results have a relatively specific character but analysis of them has indicated methods whereby tritium radiation hazards can be reduced in this type of work. (UK)

9493 USE OF PRECISION THERMOLUMINESCENCE DOSIMETRY FOR INTERCOMPARISON OF ABSORBED DOSE. Rossiter, M. J. (National Physical Lab., Teddington, Eng.). Phys. Med. Biol.; 20: No. 5, 735-746(Sep 1975).

A technique is described for making thermoluminescence measurements on phosphor powder with a relatively high degree of precision. Factors such as the rate of fading of TL response and extent of supralinearity for TLD-700 in the therapy-dose range have been measured in relation to its use for precise absorbed dose intercomparison studies in cobalt-60 beams. The results of such a trial intercomparison of six British radiotherapy centers are given, the performance of the TLD technique being matched against that of Fricke dosemeters. Factors involved in the extension of the technique to medium-energy X-rays are discussed including the possibility of determination of beam quality by employing TLD-700 and $CaSO_4$:Dy "in tandem." (auth)

9494 EXTERNAL DOSE ESTIMATES FOR FUTURE INHABITANTS OF ENIWETOK ATOLL. Gudiksen, P. H. (Univ. of California, Livermore); Jones, D. E.; Beck, H. L. Nature (London); 257: No. 5524, 284-287(25 Sep 1975).

It is stated that with the prospect of rehabitation in the near future a comprehensive survey of the radiological environment of Eniwetok Atoll has been undertaken with a view to providing a basis for determining whether or not the Atoll can be safely reinhabited by the former Marshallese population. The survey included a study to asses the total external dose that the returning population might receive; this dose would be almost entirely from γ-emitting nuclides. It is concluded that the mean population doses would be comparable with mean USA values. (UK)

9495 RELATIONSHIP BETWEEN CHROMOSOME ABERRATIONS AND LOW LET RADIATION DOSE TO HUMAN LYMPHOCYTES. Lloyd, D. C. (National Radiological Protection Board, Harwell, Eng.); Purrott, R. J.; Dolphin, G. W.; Bolton, D.; Edwards, A. A.; Corp, M. J. Int. J. Radiat. Biol.; 28: No. 1, 75-90(Jul 1975).

In vitro dose-response curves of unstable chromosome aberrations in human lymphocytes have been obtained for 250 kV X-rays and cobalt-60 γ radiation. The aberration yields have been fitted to the quadratic function $Y = \alpha D + \beta D^2$, which is consistent with the single-track and two-track model for aberration formation. The values of the coefficients α and β support the hypothesis that the dose-rate effect is limited to the D^2 term. The main difference between the coefficients for x- and γ-radiation was in the α values, indicating that x rays were slightly more efficient, at lower doses, in producing two lesions with a single ionizing track. The lower limits of dose estimate, with 500 cells analyzed, were 4 rad for x rays and 10 rad γ radiation. Further evidence is presented confirming that, for cytogenetic dosimetry, in vitro dose-response curves should be prepared by irradiating whole blood maintained at 37°C and prior to PHA stimulation. Curves were plotted showing the variation of the number of cells without aberrations with radiation dose and the shape of these curves were compared with those from human cell survival experiments. (auth)

9496 SERUM CONCENTRATION MEASUREMENTS IN MAN OF THE RADIOSENSITIZERS Ro-07-0582. Foster, J. L. (Gray Lab. of the Cancer Research Campaign, London); Flockhart, I. R.; Dische, S.; Gray, A.; Lenox-Smith, I.; Smithen, C. E. Br. J. Cancer; 31: No. 6, 679-683(Jun 1975).

Investigations of the serum concentration in man of the radiosensitizer Ro-07-0582 (1-(2-nitro-1-imidazolyl)-3-methoxy-2-propanol), after oral administration, are reported. From preliminary experiments it was calculated that a peak concentration of at least 100 μg/ml would have to be achieved for detectable sensitization to be anticipated and to produce a dose of about 6 g would be required for a 70 kg man. Six healthy male volunteers were given single doses of between 1 and 4 gm. Serum concentration for each subject as a function of time, and the serum concentration after 4 hr as a function of dosage expressed in mg/kg body weight, are shown graphically. From these data it is concluded that the drug is quickly absorbed from the upper gastrointestinal tract and that the period of 2 to 4 hr after administration would be the best time for concomitant radiotherapy. Tabulated results indicate that the serum half-life is independent of the dose of the drug over the 1 to 4 g range. (UK)

9497 SYMPTOMS OF RADIATION DISEASE IN SURVIVORS. I. Damage and Casualties Caused by Atomic Bomb Explosions in Hiroshima and Nagasaki. Szirmai, E. (Inst. of Nuclear Engineers, London); Medgyesy, G. J. Inst. Nucl. Eng.; 4: No. 16, 111-113(Jul 1975).

The atomic bomb explosions at Hiroshima and Nagasaki are briefly described together with damage to property and casualties. A mention is made of the categories of injuries caused by the explosions: burns, traumas, radiation damage, and gas injuries. (UK)

9498 RADIATION EXPOSURE IN THE FRG: THE NATURAL RISK. Bonka, H. Bild Wiss.; 12: No. 6, 40-43(Jun 1975). (In German).

6 figs.; 2 tabs.

The article gives a survey on the natural radiation exposure of the population of the FRG with special consideration of local variations in the radiation components. Cosmic radiation is essentially a function of the height above sea level, whereas the terrestric component shows regional variations which are due to the varying isotope content in different kinds of rock. The values in granite regions, e.g., the Black Forest, the Odenwald, and the Bayrischer Wald are up to 100 mrem higher than elsewhere. The same applies to the Kaiserstuhl which consists of basalt. Mean values and ranges of variation of the natural radiation exposure of the population of the FRG are given with regard to the radiation exposure in houses—which is, on an average, higher due to radionuclides in the walls—and to inner radiation due to radionuclides incorporated in the body. (GE)

9499 DIE STRAHLENWIRKUNG AUF DAS LYMPHSYSTEM UNTER BESONDERER BERUECKSICHTIGUNG DER KLEINEN DOSEN. (Radiation Effects on the Lymphatic System with Special Regard to Low Doses). Kaercher, K. H. (Oesterreichische Roentgengesellschaft- Gesellschaft fuer Medizinische Radiologie und Nuklearmedizin, Vienna); Streffer, C. (eds.) (Deutsche Roentgengesellschaft- Gesellschaft fuer Medizinische Radiologie, Strahlenbiologie und Nuklearmedizin e.V. (F. R. Germany). Arbeitsgemeinschaft fuer Strahlenbiologie). Berlin, F. R. Germany; Springer (1974). 110p. (In German, English).

From common congress of the Deutsche and Oesterreichische Roentgengesellschaft; Vienna, Austria (12 Apr 1973).

41 figs.; with tabs. and refs.

The present volume reproduces the lectures of a symposium which took place in the framework of the combined congress of the German and Austrian Roentgen Society in the year 1973 in Vienna. The purpose of the proceedings was to strengthen the communication between radiologists in clinical practice and the theoretical radiologists, in particular the radiobiologists. Plenty of investigations on the subject are given which deal with the effect of radiation on the various parameters. (GE)

9500 RADIATION LATE DAMAGE OF THE THORACIC MARROW AFTER IRRADIATION IN THE THORACIC REGION. Busse, O.; Wieland, C.; Egge, M. (Heidelberg Univ. (F. R. Germany). Strahlenklinik; Heidelberg Univ. (F. R. Germany). Neurologische Klinik). Med. Klin. (Munich); 70: No. 9, 385-391(Feb 1975). (In German).

1 fig.; 1 tab.; 34 refs.

A report is given about radiation late damage on the thoracic marrow, based on the case histories of 100 patients irradiated in the mediastinal region with telegamma from ^{60}Co or ^{137}Cs source between 1959, January 1st and 1972, December 31st. Seventy-seven patients were followed up during 18 months after the radiotherapy was ended; in three of them (= 4%) a radiation-induced myelopathy was found. These three cases were suffering from Hodgkin's disease, whereas in none of the patients with bronchial carcinoma—in spite of markedly higher radiation

doses—any late damage was observed. Therefore, in irradiation of the mediastinal region, the exposure of the spinal marrow should be reduced, although the dose alone is not decisive for the development of a radiation myelopathy. (auth)

9501 CONCEPT OF TARGET VOLUME OF RADIOTHERAPY. Gauwerky, F. (Allgemeines Krankenhaus St. Georg, Hamburg (F. R. Germany). Inst. fuer Strahlentherapie und Nuklearmedizin). Radiologe; 15: No. 6, 217-223(Jun 1975). (In German).

7 figs.; 20 refs.

It is emphasized to apply the prescribed target dose is not for a single point but in every case for a determined size and volume of the target. This is the target volume, wherein the ordered radiation dose should be applied. The absorbed dose within the target volume should as a rule be given as homogeneously as possible with a standard deviation not greater than ±10%. Application of target volume concept is discussed with regard to some special examples (nasopharynx, kidney, gynecological tumors). The target volume is a good basis for optimization of radiotherapy and development of criteria. This is also true for combination of radiotherapeutic methods in gynecological carcinomas. It is mandatory to make full use of the determination of the target volume concept for every single patient, if radiotherapy planning with or without computer has to be performed. (auth)

9502 BACKGROUNDS OF COMPUTER-ASSISTED TREATMENT PLANNING IN RADIATION THERAPY. van de Geijn, J. (Katholieke Universiteit Nijmegen (Netherlands). Dept. of Radiation Therapy and Nuclear Medicine). Radiologe; 15: No. 6, 224-230(Jun 1975).

4 figs.; 16 refs.

Interaction of ionizing radiation and living materials causes biological damage of temporary or permanent nature. In radiation therapy this phenomenon is used in a controlled fashion in order to stop the proliferation of malignant cells, while at the same time limiting the permanent damage to healthy tissues and organs to at least tolerable levels. Because of the often relatively small differences in response of malignant growths and normal tissues, the margins between tolerable and intolerable are so small that the greatest precision in treatment planning and execution is required. The nature of this treatment agent implies that the radiation therapist has to rely very much on instrumentally obtained and processed information, in all phases of this medical activities around the patient. In this paper a description is given of the backgrounds of computer-assisted methods which have enabled modern individualized and optimized planning for therapy with high energy x- and gamma beams. (auth)

9503 DOSE DISTRIBUTION IN ^{60}Co-IRRADIATION OF THE REGION OF AXILLARY EFFERENT LYMPHATICS IN BREAST CANCER. Wuerthner, K.; Timmermann, J.; Schroeder, B.; Haase, A. (Hamburg Univ. (F. R. Germany). Strahlenabteilung). Strahlentherapie; 150: No. 1, 3-11(Jul 1975). (In German).

6 figs.; 17 refs.

A method of postoperative irradiation of breast cancer is reported using high dosage in the area of the axillary and subclavicular efferent lymphatic ducts. Within opposite fixed fields it was possible to modify the dose distribution by means of wedges, thus obtaining a maximum value of axillary and clavicular doses, together with a small radiation load on the lymphatic vessels which drain the region of the arm. The dose distribution in the depth of the shoulder is discussed on the basis of measurements at a phantom using different adjustments of the wedge filter. The most favorable dose distribution was noted with 17.5° lead wedges whereas, however, the angular aperture in the axillary and clavicular region was reduced to 2.5°. This method is now being tested clinically. (auth)

9504 STRAHLENSCHUTZ IN HESSEN. (Radiation Protection in Hesse). Wiesbaden, F. R. Germany; Hessisches Sozialministerium (May 1974). 19p.

4 figs.; 2 tabs.

A survey is given on the tasks of the administration of Land Hesse in the field of radiation protection. The responsible authorities are the Social Ministry and its subordinate agencies, in particular the Industrial Control Office and the Inspection Office for Industrial Administration. The measures taken by the authorities are subject to the Atomic Energy Act and its executive regulations such as the 1st Radiation Protection Ordinance governing the use of radioactive materials and radiation protection in nuclear facilities, the 2nd Radiation Protection Ordinance for the use of radioactive materials and x-ray equipment in schools, and the x-ray Ordinance for the use of x-ray installations and stray radiation. The competence for licensing and control of nuclear reactors and other applications of nuclear fuels is in the hands of the Ministry of Economy and Technology. The licenses are granted in accordance with the Social Ministry and the Ministry of the Interior. (GE)

9505 TREATMENT OF RADIATION DAMAGE. Catsch, A. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Strahlenbiologie). Z. Versicherungswiss.; No. 1, 125-131(1975). (In German).

From annual meeting of the Deutscher Verein fuer Versicherungswissenschaft e.V.; Karlsruhe, F. R. Germany (5 Mar 1975).

3 refs.

The publication gives a survey on the state of knowledge about the treatment of the acute radiation syndrome which develops within the first 6 weeks after short-time, whole-body irradiation. (GE)

9506 COMPARISON OF THE RADIATION DOSE FROM FILM AND XERORADIOGRAPHY. Evers, R.; Roemer, M. (Heidelberg Univ. (F. R. Germany). Roentgenabteilung; Knappschafts-Krankenhaus, Dortmund (F. R. Germany). Abt. fuer Roentgenologie und Nuklearmedizin). Fortschr. Geb. Roentgenstr. Nuklearmed.; 123: No. 1, 69-71(Jul 1975). (In German)

4 figs.; 2 tabs.; 24 refs.

Using a LiF dosimeter, comparative measurements were carried out on film mammography and xeromammography on surface and exit dose to the breast and scatter at the level of the gonads. Exit dose at 200 to 330 mR was approximately the same for both methods; incident dose at 6,800 mR for film mammography was significantly higher than for xeromammography at 3,800 mR (Mo tube) or 1,200 mR (tungsten tube). Scatter at the level of the gonads for all three methods was between 4.4 and 12.8 mR. For xeroradiography of the knee joint, the radiation dose of 466 mR was approximately three times that for a film technique (160 mR). (auth)

9507 CALCULATIONAL TECHNIQUES FOR ESTIMATING POPULATION DOSES FROM RADIOACTIVITY IN NATURAL GAS FROM NUCLEARLY STIMULATED WELLS. Barton, C. J.; Moore, R. E.; Rohwer, P. S.; Kaye, S. V. (Oak Ridge National Lab., TN). pp 343-354 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

Techniques for estimating radiation doses from exposure to ^{85}Kr and tritium in combustion products of natural gas obtained from wells created by use of nuclear explosives were first developed in the Gasbuggy Project. These techniques were refined and extended by development of a number of computer codes in studies related to the Rulison Project, the second in the series of joint government-industry efforts to demonstrate the feasibility of increasing natural gas production from low-permeability rock formations by use of nuclear explosives. These techniques are described and dose estimates that illustrate their use are given. These dose estimation studies have been primarily theoretical, but we have tried to make our hypothetical exposure conditions correspond as closely as possible with conditions that could exist if nuclearly stimulated natural gas is used commercially. (auth)

9508 ACCURACY IN PATIENT SETUP AND ITS CONSEQUENCE IN DOSIMETRY. Kartha, P.K.I.; Chung-Bin, A.; Wachtor, T.; Hendrickson, F.R. (Department of Therapeutic Radiology, Rush University and College of Medicine, Chicago, Illinois 60612). Med. Phys. 2: No. 6, 331-332 (Nov 1975).

Analysis of 5575 settings on a computer-monitored Theratron-80 ^{60}Co unit demonstrates that human error does occur in treating patients with radiation. The errors are due to inaccurate setting of such parameters as field size, gantry angle, collimator rotation, treatment time, etc. The error rate per parameter was found to be about 3%, and more than two-thirds of the patients monitored with the PDP 11/45 computer had at least one error at some stage during the full course of treatment. Both the dose and the dose distribution may be affected by these errors and have been studied in a few typical cases. The errors in timer setting have the largest effect on the prescribed dose and may change the probability of local control appreciably. (auth)

9509 DIRECT MEASUREMENT OF BETA DOSE RATES IN TISSUE AT PROTECTION LEVELS. Rao, I. S. S.; Naik, S. B. (Bhabha Atomic Research Center, Bombay). Health Phys.; 29: No. 5, 747-751(Nov 1975).

A parallel plate ionization chamber having a thin (4 mg/cm^2) graphited mylar as the entrance window for the measurement of skin dose due to external β radiation at protection levels is described. The collector (4 cm diameter) and guard electrodes of the ion chamber were formed on a 1.25-cm-thick perspex backscatterer and the ionization in the air volume was measured for various plate spacings ranging from 1.6 to 40 mm. Ionization currents per gram of air for vanishingly small mass of air were

determined by graphical extrapolation. The extrapolated value was used for the estimation of skin dose. Plane electro-deposited sources of $^{90}Sr + ^{90}Y$ and ^{204}Tl have been calibrated in terms of skin dose at 30 cm and used for the calibration of scintillation type beta dose rate meters. The overall uncertainty in the determination of skin dose by the parallel plate chamber has been estimated to be better than 8% at a dose level of 1 rad/hr. (auth)

9510 OCCUPATIONAL RADIATION EXPOSURE DUE TO ^{222}Rn IN NATURAL GAS AND NATURAL GAS PRODUCTS. Gesell, T. F. (Univ. of Texas, Houston). Health Phys.; 29: No. 5, 681-687(Nov 1975).

The potential hazard of occupational exposure to the radiations of ^{222}Rn and its daughters in the natural gas industry is examined. The results of a study of ^{222}Rn concentrations and external radiation fields in nine geographically diverse natural gas processing plants are given, and the results are interpreted in terms of occupational exposure. It is concluded that while both internal and external exposures to the radiations from ^{222}Rn and its short-lived daughters do occur, the magnitudes of the exposures are not serious. The potential problem of exposure during maintenance operations to long-lived ^{222}Rn daughters which may build up on the interior surfaces of gas processing equipment is recognized but not resolved. (auth)

9511 HEALTH PHYSICS TRAINING OPPORTUNITIES. Yarbro, C. L. pp 50-57 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).

From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

9512 SIZES OF POPULATION NEEDED TO DETECT AN INCREASE IN DISEASE RISK WHEN THE LEVELS OF RISK IN THE EXPOSED AND THE CONTROLS ARE SPECIFIED. Examples from Cancer Induced by Ionizing Radiation. Goss, S. G. (National Radiological Protection Board, Harwell, Eng.). Health Phys.; 29: No. 5, 715-721(Nov 1975).

Graphs are derived for finding readily the expected numbers of disease cases required in order to have a 50, 95, or 99% chance of detecting an increased risk at the nominal 5% level of significance when the levels of risk in the exposed and control populations are specified. (auth)

9513 IMPLEMENTATION OF A NATIONWIDE PROGRAM ON HEALTH AND SAFETY OF MEDICAL X RAYS. Cheng, C. H. (Atomic Energy Council of Executive Yuan, Taipea, Taiwan); Liu, K. Y.; Yung, C. T.; Weng, P. S. Health Phys.; 29: No. 5, 802-803(Nov 1975).

The major radiation protection problem in Taiwan is the improper use of x rays for diagnostic and therapeutic purposes. A survey of the 63 x-ray units in the country revealed that about 40% of these had tube leakage exceeding 100 mR/hr at 1 m from the target and that of the 1191 operators checked only 370 had personnel monitors. To overcome this problem training sessions for doctors and for x-ray operators have been undertaken and licensing measures for the import and installation of x-ray machines have been adopted. (UK)

9514 HEALTH PHYSICIST AND NUCLEAR POWER PLANT DESIGN. Odor, D. L. (Public Service Indiana, Plainfield). Health Phys.; 29: No. 5, 799-801(Nov 1975).

The entire discipline of health physics is challenged during the design phase of a nuclear facility. By maintaining a technical understanding and communicating with the other members of the project team he can help ensure that safety related radiological control requirements will be met and can provide a significant contribution to solving the needs of the electric utility. (UK)

9515 RADIATION-INDUCED DICENTRICS IN HUMAN LYMPHOCYTES AS A MODEL FOR THE ANALYSIS OF RELATIVE GENETIC EFFICIENCY. Todorov, S. L. (Center for Infectious and Parasitic Diseases, Sofia). C. R. Acad. Bulg. Sci.; 28: No. 4, 573-575(1975). (In Bulgarian)

Determinations of the relative genetic efficiency (RGE) of 180 kV x rays, ^{60}Co gamma rays, 50 MeV protons, and fission neutrons were made on the basis of the number of dicentrics induced in human lymphocytes. Whole blood was irradiated with doses in the 30 to 700 rad range, whereupon the lymphocytes were cultivated by methods described by Todorov, et al, in earlier work. In the dose range in question, the number of induced dicentrics per cell increased from 0.05 to 1.00 with the dose. The RGE was calculated as the ratio of the x-ray radiation dose inducing a given number of dicentrics to the dose of investigated radiation inducing the same number of dicentrics. The average value of RGE over the dosage range applied was 0.86, 0.76, and 2.14 for protons, gamma radiation, and fission neutrons, respectively. (JPRS)

9516 RADIATION LOADING OF PERSONS WORKING WITH X- AND GAMMA-RAY SOURCES IN BULGARIA. Analysis of Personal Film Radiation Monitoring System Data for 10 Years (1964-1974). Vasilev, G.; Karadzhov, A.; Filev, G.; Khristova, M.; Batsev, S. Rentgenol. Radiol.; 14: No. 2, 144-147(1975). (In Bulgarian)

The article summarizes the results of a 10-year systematic study of the radiation loading of personnel working with x- and gamma-ray sources based on the method of personal film radiation monitoring. Most personnel in medicine and industry (89.5 to 99.3%) received annual doses below 0.5 rads, i.e. less than one-tenth of the maximum permissible occupational irradiation dose (5 rems per year). Those working with gamma-ray sources in industry received a higher irradiation dose than those working with gamma- and x-ray sources in medicine, science, and education. The percentage of persons who received annual irradiation in excess of the maximum permissible doses is 0.2% for all sectors for 10 years. There has been a trend towards higher annual irradiation doses for persons working with gamma-ray sources in industry as a result of the wider use of gamma-ray flaw detection. A comparison of the data for Bulgaria with corresponding data for Belgium, East Germany, and Poland shows that the dose values and distribution are the same for these countries. (JPRS)

9517 BIOLOGICAL EFFECTS OF COSMIC RADIATION. Saunders, J. F. Prog. Biometeorol., Div. A; No. 1A, 381-391 (1974).

There is absolute evidence that HZE particles did penetrate spacecraft during space flight missions in earth orbit and beyond. On the basis of dosimetric information, we must conclude, however, that the intensity of the particles is indeed low. Further quantitative evidence is lacking for any biologic interaction with the HZE particles of cosmic origin. In view of the sparce information available, one can only speculate, at this time, on the nature of galactic cosmic radiation and whether or not it constitutes a serious threat to the exploration of space by man. At this point of incomplete knowledge, is the problem as critical as to jeopardize man's creative imagination, his scientific curiosity and flexibility, and his destiny for progress and discovery? The instruments and black boxes in automated satellites can provide facts to fill some of the gaps in our knowledge, but only man can interpret this information, recognize new problems and conceive of means for studying them scientifically for the benefit of all mankind. (auth)

9518 HEALTHY PILOT. Ramsden, J. M. Flight Int.; 107: 647-649(17 Apr 1975).

Dangers to flight safety presented by pilots with heart problems are considered, taking into account diagnostic approaches which are used to recognize critical cases. Medical research and investigations designed to explore the significance of human factors in flight safety are discussed, giving attention to requirements for flight-time limitations, the effect of hypnotics and drugs, automatic-landing studies, the medical problems of supersonic flight, and cosmic-radiation effects. (IAA)

9519 CLINICAL PICTURE AND TREATMENT OF REMOTE AFTEREFFECTS OF RADIATION AND SURGICAL TRAUMA OF THE LARYNX IN CHILDREN WITH PAPILLOMATOSIS. Yunina, Z. I.; Bagoshvili, V. A. (Moscow Scientific-Research Inst. of Ear, Throat, and Nose). Vestn. Otorino-Laringol.; 2: 53-58 (1974). (In Russian)

There were 12 patients with scar stenosis, atresia, deformities and defects of the walls of the air-conducting and food-conducting tracts, developing after x-ray therapy and surgical therapy of papillomatosis of the larynx in children. Respiration in these patients was realized through a tracheostome, two patients were fed through a gastrostome. There was noted a marked sclerosis and a loss of plasticity of neck tissues in the area of irradiation, underdevelopment and deformity of laryngeal elements. The first stage of the treatment was restoration of patency of the food-conducting tract, the second — of the respiratory tract. Lacking parts of the larynx and trachea were restored with the aid of Filatov's tube with an implanted auto- or homotransplant into it. Only 5 of 12 patients were cured; in 2 cases food-conducting passages were restored and they could do without a gastrostome. The rest of the patients are at various stages of restorative therapy. Our observations indicated x-ray therapy to be harmful in papillomatosis of the larynx during the period of growth and formation of the organism and also pointed to considerable difficulties in elimination of the structure and restoration of the function of cervical organs in children because of the severity of affection and disturbances of repair processes. (auth)

9520 DOSIMETRY OF WHOLE-BODY IRRADIATION WITH ELECTRONS IN THE MANAGEMENT OF MYCOSIS FUNGOIDES.

Botha, J. C.; Kok, J. C.; Duvenage, J.; Minnaar, P. C.; Anderson, J. D. (Univ. of the Orange Free State, Bloemfontein, S. Afr.). S. Afr. Med. J.; 48: No. 59, 2479-2481(7 Dec 1974). (In Afrikaans)

A six-field method for whole-body radiation with 3.4 MeV electrons obtained from a Mevatron 8 linear accelerator is described. The physical properties of the electrons are given, and a method is described whereby the whole-body isodose distributions can be predicted during whole-body irradiation. (auth)

9521 TREATMENT OF GRAVE-BASEDOW'S DISEASE ASSOCIATING PROLONGED ANTITHYROID MEDICATIONS AND SMALL DOSES OF ^{131}I PRESCRIBED WITHOUT DOSIMETRY. Jaffiol, C.; Baldet, L.; Robin, M.; Papachristou, C.; Mirouze, J.; Lapinski, H. (Hopital Saint-Eloi, Montpellier Cedex, France). Ann. Endocrinol. (Paris); 35: No. 1, 34-35(1974). (In French)

An initial low dose of ^{131}I was completed by the prescription of antithyroid drugs and DL T3 in 293 cases of hyperthyroidism. 189 of them absorbed only one while 104 patients absorbed 2 or more doses of radioactive iodine until recovery of hyperthyroidism. The first year incidence of hyperthyroidism (3.07%) and its annual increase (2.17%) are lower than in series where initial irradiation of the thyroid was greater. A relationship exists between hypothyroidism, ^{131}Iodine dose, gland size, and nodularity, but only in patients treated with one dose. Recovery of hyperthyroidism is faster among patients cured with one dose only (12% of persistent thyrotoxicosis the 3d post radio-iodine year) than among patients treated by several doses (67% of persistent thyrototoxicosis the 3d year). The frequency of relapses (1.71%) is less than usually observed in patients treated with antithyroid drugs only. (auth)

9522 PATHOLOGICAL INVESTIGATION OF RADIATION NECROSIS: COMPLETE NECROSIS OF BRAIN TUMORS OBSERVED IN AUTOPSY CASES. Nakamura, N.; Ogawa, H.; Kumanishi, T.; Ikuta, F.; Ueki, K. (Niigata Univ., Japan). Neurol. Surg. (Tokyo); 2: No. 3, 213-220(1974). (In Japanese)

The paper is a morphological description of six cases of severe necrosis of the tumors undoubtedly attributable to the irradiation, found in the course of studying the effect of radiation therapy in 84 autopsy cases of intracranial tumors including 59 gliomas. In two cases of craniopharyngioma and of pineal teratoblastoma (biopsied previously), massive, hyalinous, scar-like connective tissues were present without residual tumor cells. In the former case, marked coagulation necrosis co-existed in the white matter of the right temporal lobe without compressing or dislocating the surrounding tissue, conceivably to be a radiation necrosis of the white matter itself. Also ascertained is the fact that the brain tissue shows no remarkable change in volume by irradiation, regardless of the existence of coagulation necrosis. The 3rd and 4th cases were of anaplastic glioma (biopsied previously) which showed extensive coagulation necroses at the portion corresponding to the left thalamus (Case 3) and the centrum semiovale of the right cerebrum (Case 4) with small number of residual tumor cells in their marginal zone. These necrotic lesions were so extensive that the surrounding structures were compressed and dislocated. Under the clinical diagnosis of glioma, the 5th and 6th cases had received irradiation but not any operative treatment. Extensive and massive coagulation necroses were present in the cerebrum (Case 5) and brainstem (Case 5,6) compressing and dislocating adjacent structures. In both cases no identifiable glioma cells were observed. However, the morphological findings of the voluminous necrotic lesion similar to those of Case 3 and Case 4 allowed us to conclude that the gliomas had been led to complete coagulation necrosis by irradiation in Case 5 and Case 6. The patho-anatomical findings described here suggest that the glioma maintains the original size and volume in mass, even if it led to coagulation necrosis by irradiation. (auth)

9523 RADIATION-RELATED PERICARDITIS. Martin, R. G.; Ruckdeschel, J. C.; Chang, P.; Byhardt, R.; Bouchard, R. J.; Wiernick, P. H. (US Public Health Service Hospital, Baltimore). Am. J. Cardiol.; 35: No. 2, 216-220(Feb 1975).

To determine the incidence of pericardial effusion in patients undergoing upper mantle radiation therapy, 81 patients with Hodgkin's disease, stages I to IIIB, were selected from a protocol series of 98 patients. Twenty-four patients (29.6 percent) met X-ray criteria for the presence of pericardial effusion. Eleven of the 24 also underwent right heart catheterization to confirm the presence of pericardial effusion and to define any hemodynamic abnormality. Fourteen patients were found to have transient effusion. Five of the 11 patients have had partial pericardiectomy for symptoms and signs of cardiac tamponade. There has been no evidence of recurrent Hodgkin's disease in these surgically treated patients. Ninety-two percent of the pericardial effusions occurred in the first 12 months after the end of radiation therapy. Therapeutic implications depend on elucidation of the natural history of this process. At present close follow-up is necessary with surgical intervention for signs or symptoms of cardiac tamponade.(auth)

9524 DELAYED CEREBROVASCULAR CONSEQUENCES OF THERAPEUTIC RADIATION: A CLINICOPATHOLOGIC STUDY OF A STROKE ASSOCIATED WITH RADIATION-RELATED CAROTID ARTERIOPATHY. Conomy, J. P.; Kellermeyer, R. W. (Cleveland Clinic Foundation). Cancer; 36: No. 5, 1702-1708 (Nov 1975).

A young woman, successfully treated for Hodgkin's disease with radiation and MOPP chemotherapy, incurred a devastating stroke months after radiation therapy to the neck and other areas. There was no premonitory clinical history of cerebrovascular attacks. Autopsy showed unilateral thrombotic occlusion of the internal carotid artery unassociated with neoplastic or fibrotic annular constriction of the vessel. There was medial thickening and fibroblastic proliferation within the carotid artery. Areas of focal elastic membrane degeneration involved the cervical portions of the carotid. Thrombus was organized to the damaged vessel wall and was propagated into the intracranial vessels. Aneurysm formation and arterial hemorrhages were absent. These vascular changes occurred in an area of extensive radiation (7200 rads). Pathoanatomical studies in this patient indicate that radiation-induced vascular changes were associated with a delayed stroke. (auth)

9525 LUNG CANCER AT AUTOPSY IN A-BOMB SURVIVORS AND CONTROLS, HIROSHIMA AND NAGASAKI, 1961-1970. II. Smoking, Occupation and A-Bomb Exposure. Ishimaru, T.; Cihak, R. W.; Land, C. E.; Steer, A.; Yamada, A. (Atomic Bomb Casualty Commission, Hiroshima). Cancer; 36: No. 5, 1723-1728(Nov 1975).

The apparent effect of ionizing radiation on lung cancer in A-bomb survivors has not been large enough to still doubts as to its validity. It has seemed essential to determine whether the apparent radiation effect could have resulted from a confounding of heavy smoking and high radiation dose, or if the occupational exposure of high-dose subjects with lung cancer was suggestive of the influence of environmental hazards other than radiation. The available series consists of 204 subjects with lung cancer verified by autopsy, 61 of whom were low-dose (less than 1 rad) and 13 high-dose (200+ rads) subjects. No evidence could be found that the influence of either smoking or occupational exposure upon lung cancer was exerted so as to suggest that the apparent radiation effect is other than real. The study also provides additional evidence of the relationship between lung cancer and smoking in Japan. (auth)

9526 DOSES TO THE VERTEBRAL MARROW DURING COMMON X-RAY EXAMINATIONS IN CLINICAL SITUATIONS. Seidlitz, L.; Margulis, A. R. (Univ. of California, San Francisco). Invest. Radiol.; 9: No. 6, 419-424(1974).

Increasing concern about somatic effects of low doses of x radiation to blood-forming organs led to direct measurements of the exposure of 60 adult patients during actual clinical procedures in a university teaching hospital. The peak skin exposure ranged from 1.99 R for an intravenous pyelogram to 263 R for abdominal angiography. From these measurements, the vertebral marrow doses were calculated and the peak values were found to range from 0.11 to 54 rad. The integral dose to the entire vertebral marrow ranged from 90 to 5400 g-rad in abdominal angiography and from 760 to 2900 g-rad in cardiac cineangiography. The magnitude of these doses points to the need for a conservative approach to multiple-injection angiography in view of indications of somatic damage from irradiation. The exposure given in these examinations should be consciously minimized. (auth)

9527 RETINAL INJURY FROM A WELDING ARC. Naidoff, M. A.; Sliney, D. H. (Aberdeen Proving Ground, MD). Am. J. Ophthalmol.; 77: 663-668(May 1974).

An 18-year-old man stared at a welding arc for approximately ten minutes, sustaining moderate facial erythema, keratoconjunctivitis, marked visual loss, a pupillary abnormality, and a retinal injury accompanied by a dense central scotoma and peripheral field constriction. A residual, partially pigmented foveal lesion remained after 16 months, with normal visual acuity. Since the degree of keratoconjunctivitis and facial erythema was known, we substantiated the duration of exposure to the arc by weighting the known action spectrum of moderate ultraviolet erythema with the ultraviolet spectral irradiance measurements of the arc. From the radiometric measurements of the visible brightness and visible and near infrared spectrum of the arc and from knowledge of pupil size, we calculated the retinal exposure dose rate, which was less than normally considered necessary to produce a chorioretinal burn. This case may provide a clinical example of photic maculopathy recently reported in experimental investigations. (auth)

9528 ENIGMA OF POST-RADIATION EDEMA AND RECURRENT OR RESIDUAL CARCINOMA OF THE LARYNX. Ward, P. H.; Calcaterra, T. C.; Kagan, A. R. (Univ. of California, Los Angeles). Laryngoscope; 85: No. 3, 522-529(Mar 1975).

From centennial conference on laryngeal cancer; Toronto, Ont., Canada (28 May 1974).

Persistence of significant edema of the larynx beyond six months after completion of radiotherapy presents the laryngologist with a diagnostic dilemma. Review of the results of 43 cases demonstrated a high incidence of residual or recurrent carcinoma. Based upon this experience earlier and frequent laryngeal biopsies are recommended for these cases. (auth)

9529 VOICE FOLLOWING RADIOTHERAPY. Stoicheff, M. L. (Univ. of Toronto). Laryngoscope; 85: No. 4, 608-618 (Apr 1975).

From centennial conference on laryngeal cancer; Toronto, Ont., Canada (28 May 1974).

This study was undertaken to provide information on the voice of patients following radiotherapy for glottic cancer. Part I presents findings from questionnaires returned by 227 of 235 patients successfully irradiated for glottic cancer from 1960 through 1971. Part II presents preliminary findings on the speaking fundamental frequencies of 22 irradiated patients. Normal to near-normal voice was reported by 83 percent of the 227 patients; however, 80 percent did indicate persisting vocal difficulties such as fatiguing of voice with much usage, inability to sing, reduced loudness, hoarse voice quality and inability to shout. Amount of talking during treatments appeared to affect length of time for voice to recover following treatments in those cases where it took from nine to 26 weeks; also, with increasing years since treatment, patients rated their voices more favorably. Smoking habits following treatments improved significantly with only 27 percent smoking heavily as compared with 65 percent prior to radiation therapy. No correlation was found between smoking (during or after treatments) and vocal ratings or between smoking and length of time for voice to recover. There was no relationship found between reported vocal ratings and stage of the disease. (auth)

9530 POSSIBLE ROLE OF RADIATION IN ONCOGENESIS OF MENINGIOMA. Bogdanowicz, W. M.; Sachs, E. Jr. (Hitchcock Clinic, Hanover, NH). Surg. Neurol. (Tryon, N.C.); 2: 379-383 (Nov 1974).

Three cases of psammatous meningiomas are reported. These become symptomatic and were diagnosed several years following irradiation for intracranial lesions. The pertinent literature is reviewed. It seems that radiation can be an oncogenous factor in the formation of a meningioma. Pre-existing chronic inflammatory changes in the vicinity of applied irradiation may play some role. (auth)

9531 INADVERTENT DESTRUCTION OF THE SPINAL CORD BY RADIATION THERAPY. Bhavilai, D. (Chicago Wesley Memorial Hospital). Surg. Neurol (Tryon, N.C.); 2: 333-335(Sep 1974).

A case of radiation myelopathy following cobalt therapy of a carcinoma of the esophagus is presented. A permanent quadriplegia resulted. Radiation myelopathy can result from treatment with x-rays or radioactive cobalt regardless of whether the condition being treated involves the spinal cord. No effective treatment is known. Prevention requires keeping the radiation at low level. (auth)

Vertebrates

Refer also to abstracts 9357, 9433, 9434, 9446, and 9450.

9532 (AECL-5115) FIELD IRRADIATOR γ: PREIRRADIATION OCCURRENCE OF BREEDING BIRDS IN THREE BOREAL HABITATS. Seabloom, R. W. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Oct 1975. 17p. Dep. NTIS (US Sales Only) $4.50.

A trail census was conducted of the breeding birds found in three major habitats in the Field Irradiator γ area at the Whiteshell Nuclear Research Establishment, Pinawa, Manitoba. The area sampled was about 10.50 ha in size, and included 4.25 ha of upland forest, 4.75 ha of lowland conifers, and 1.50 ha of black spruce-tamarack bog. Forty-four species of birds were identified, of which 24 were considered to be resident in the study area. The highest population density was observed in the bog, followed by upland forest and lowland conifer, respectively. In contrast, species diversity was greatest in the upland forest, while it decreased markedly in the relatively monotypic lowland conifer and bog habitats. (auth)

9533 (AECL-5254, pp 47-52) POPULATION RESEARCH BRANCH. Newcombe, H. B. Sep 1975.

In Biology and Health Physics Division progress report, April 1 - June 30, 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Studies on tumor induction in mammals included experiments with rats to determine whether cigarette tar and other carcinogens when applied to the skin following exposure to beta rays would result in the development of more tumors than would be caused by radiation alone. Methods for deriving human data on diseases likely to be increased by irradiation were studied with regard to organization of birth and marriage records; linking ill-health records for children to birth summary records; linking ill-health records into individual health histories; ascertainment of congenital malformations through hospital records; maternal irradiation and Down's syndrome; and collaboration with outside agencies. (HLW)

9534 (ORNL-5072) BIOLOGY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1975. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 208p. Dep. NTIS $7.60.

Separate abstracts were prepared for each of the six sections. Four sections were included in Nuclear Science Abstracts and six were included in ERDA Research Abstracts. (HLW)

For abstracts of individual sections see: 9535-9538.

9535 (ORNL-5072, pp 31-60) BIOPHYSICS AND CELL PHYSIOLOGY. Mazur, P. Nov 1975.

In Biology Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Progress is reported on research activities in the fields of physiology and low-temperature biology of mammalian embryos; effects of sub-zero temperatures on eggs and embryos of sea urchins; survival of frozen-thawed human red cells; effects of radiation on physiology of Escherichia coli; transfer of triplet electronic energy in dinucleotides; effects of x radiation on DNA degradation; energy deposition by neutrons; photosynthesis, excision repair of uv-induced pyrimidine dimers in DNA of plant cells. (HLW)

9536 (ORNL-5072, pp 61-112) GENETICS AND DEVELOPMENT BIOLOGY. Barnett, W. E. Nov 1975.

In Biology Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Progress is reported on research activities in the fields of mutagenesis in Haemophilus influenzae and Escherichia coli; radioinduced chromosomal aberrations in mammalian germ cells; effects of uv radiation on xeroderma pigmentosum skin cells; mutations in Chinese hamster ovary cells; radioinduced hemoglobin variants in the mouse; analysis of mutants in yeast; Drosophila genetics; biochemical genetics of Neurospora; DNA polymerase activity in Xenopus laevis oocytes; uv-induced damage in Bacillus subtilis; and others. (HLW)

9537 (ORNL-5072, pp 113-144) MAMMALIAN GENETICS. Russell, W. L. Nov 1975.

In Biology Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Progress is reported on research activities in the fields of translocations and inversions in post-meiotic germ cells of male mice; mutagenicity of sulfur dioxide and ethyl alcohol in mice; mutation frequencies induced in mouse spermatogonia at very low radiation dose rates; discovery of tandem duplication in the mouse; radioinduced hemoglobin variants in the mouse; chemical mutagenesis in mice; protein differences related to genetic differences at single loci; effects of x radiation on DNA synthesis in germ cells of male mice; and others. (HLW)

9538 (ORNL-5072, pp 145-174) PATHOLOGY AND IMMUNOLOGY. Storer, J. B. Nov 1975.

In Biology Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Progress is reported on research activities in the fields of radioprotection of mice by phenylhydrazine-damaged erythrocytes; mechanisms of radiation leukemogenesis in mice; recovery of immune competence following sublethal irradiation; effects of fast neutrons and x rays on mouse embryos; effects of x radiation on butylated hydroxytoluene or diethylnitrosamine treatment in mice; effects of neutrons on incidence of neoplastic diseases; DNA synthesis in megakaryocytes; pathogenesis of radioinduced leukemia in mice; recovery from radiation and chemical carcinogenic injury to mouse lung; and others. (HLW)

9539 (PE-237803) MUTAGENICITY TESTS OF FOREIGN SUBSTANCES. Ehling, U. H. Translated from Schriftenr. Ver. Wasser, Boden, Lufthyg., Berlin Dahlem; 40: 21-37(1973). 27p. (EPA-TR-496-74). NTIS $3.75.

The analyses of chemical and radiation induced chromosome mutations and of the molecular mutation mechanism with simple

test systems are important decision aids in the choice of agents which are to be tested in mammal research. The advantages and disadvantages of the various testing methods are reviewed in detail in this report. (GRA)

9540 (UR-3490-511) RENAL AND ADRENAL FACTORS IN RADIATION-INDUCED HYPERTENSION AND NEPHROSCLEROSIS. Lurie, A. G. (Rochester Univ., N. Y. (USA). Dept. of Radiation Biology and Biophysics). 1973. 224p. Dep. NTIS $7.75.

Thesis.

Experiments were conducted in order to investigate the effects of adrenalectomy on the incidence, severity, and rate of progression of radiation-induced hypertension and nephrosclerosis in male rats. Adrenalectomized and non-adrenalectomized rats received either a single exposure of 500 R or 2000 R x radiation bilaterally to temporarily exteriorized kidneys, or a single exposure of 500 R to the whole body with shielding of temporarily exteriorized kidneys. Animals were sacrificed for study at 5 or 10 weeks following surgery and/or irradiation. The parameters which were evaluated included: systolic blood pressure; gross pathology; renal histopathology; food and fluid intake; urine output; urine and plasma potassium, sodium, and chloride concentrations; plasma corticosterone concentration; total body weight; and other organ weights (kidneys, spleen, heart, hypophysis, and adrenals). Additional studies were performed on selected rats to determine: the plasma renin and angiotensin activity; and the effects of adrenalectomy performed 3 months after bilateral renal irradiation on systolic blood pressure and renal histopathology. Hypertension and arteriolonephrosclerosis (ANS) were produced by all doses and all modes of irradiation in all adrenalectomized and non-adrenalectomized rats. (auth)

9541 EFFECT OF IONIZING RADIATIONS ON THE ASCORBIC ACID CONTENT IN THE VITREOUS BODY OF THE RABBIT. Zygulska-Mach, H.; Maciejewski, Z. (Akademia Medyczna, Krakow (Poland). Clinic for Eye Diseases). Klin. Monatsbl. Augenheilkd.; 165; No. 6, 892-894(Dec 1974). (In German).

1 tab.; 6 refs.

The authors report on the destructive effect of ionized rays on the eye ball. The ascorbic acid content in the vitreous of rabbits subjected to radiation with cobalt-60 using Stallard applicators was determined. The left eye which served as the non-radiated partner eye of the test object was employed as a control. Attention is drawn to a certain amount of reduction of the ascorbic acid content in the vitreous which is indirectly proportional to the employed quality of the rays. The changes were similar in those eyes which were not directly subjected to radiation. There changes were however not so much pronounced. Attention is drawn to the important role of ascorbic acid in vitreous metabolism. The authors point out that radiation damage can be found even in the eye that is not directly subjected to radiation. (auth)

9542 EFFECTS OF 5-FLUOROURACIL AND IRRADIATION ON CELL KINETICS OF THE WALKER CARCINOMA AND SMALL INTESTINE IN RATS. Jentzsch, K. (Vienna Univ. (Austria). Strahlentherapeutische Klinik; Vienna Univ. (Austria). Inst. fuer Klinische Strahlenbiologie). Strahlentherapie; 150: No. 1, 51-62(Jul 1975). (In German).

5 figs.; 29 refs.

A therapeutic schedule of synchronizing cytostatical-radiological treatment often used in human medicine is applied to rats carrying a Walker tumor. The effect of this treatment on the kinetics of tumor cells and epithelium of small intestine is investigated. 5-Fluorouracil, i.p. during 18 and 12 hours, brings about no changes in the mitotic index; however, in the curve of marked mitoses a small fraction of cells is represented which is considered to be a consequence of the synchronization of a very small portion of tumor cells. If ten hours after 5-FU-injection the cells are irradiated with a single dose of 300 rd, there occurs a distinct G_2-block and a lengthening of the S-phase. These changes are found both in the 5-FU group and in the controls. 5-FU-injection thrice alternated with irradiation likewise causes a G_2-block. After solution of the block a delayed increase of mitoses in the controls is going on which cannot be detected in the 5-FU group. These findings are interpreted as an effect of 5-FU on the proliferation rate of tumor tissues. (auth)

9543 FURTHER INVESTIGATIONS ON THE RADIOPROTECTIVE EFFECTIVENESS OF DIANABOL AND OTHER DRUGS IN FRACTIONATEDLY IRRADIATED RATS. Kocmierska-Grodzka, D.; Radwan, J. (Akademia Medyczna, Bialystok (Poland). Zaklad Farmakologii). Strahlentherapie; 150: No. 1, 91-96(Jul 1975).

2 figs.; 1 tab.; 18 refs.

Dianabol administered p.o. in the dose of 1.0 mg/kg during 10 days before irradiation had no radioprotective effect in the fractionated irradiation (5 × 150 R). Distinct radioprotection, however, was exerted by the DMSO, Trasylol and Trichlorfon (30 mg/kg) administration. (auth)

9544 STUDIES CONCERNING THE METABOLISM OF CALCIUM IN BONES AFTER LOCAL X IRRADIATION. XIII. Influence of Castration and Estrogens upon the General Response of Male Rats. Babicky, A.; Kolar, J.; Kalouskova, J. (Ceskoslovenska Akademie Ved, Prague. Isotopova Laborator Biologickych Ustavu; Ceskoslovenska Akademie Ved, Prague. Fyziologicky Ustav). Strahlentherapie; 150: No. 1, 36-43(Jul 1975). (In German).

10 figs.; 6 refs.

The course of local and general deviations in osseous tissue of locally irradiated male white rats is different in hormonally not influenced and in castrated animals. By castration, both the intensity and the variations of this response are inhibited, whereas especially the sound osseous tissue shows a great deal more sensitivity. The male sex hormones thus lead to a certain instability and intensity of the defence reactions against local radiation damage which derail more easily than in females. (auth)

9545 T-LYMPHOCYTE LEVELS IN THE PERIPHERAL BLOOD OF GAMMA-IRRADIATED MONKEYS. Olkowski, Z. L.; McClure, H. M.; McLaren, J. R. (Emory Univ., Atlanta, Ga. (USA). Radiation Therapy Div.; Emory Univ., Atlanta, Ga. (USA). Yerkes Regional Primate Research Center). Strahlentherapie; 150: No. 1, 63-69(Jul 1975).

5 figs.; 22 refs.

Circulating Thymus-derived (T) lymphocytes were studied in Rhesus monkeys exposed to a single whole-body gamma radiation with doses of 400, 500, and 600 Rad. Spontaneous lymphocyte rosette assay (E-rosettes) was used to evaluate the level of T-lymphocytes. A decrease in total leukocytes, lymphocytes, and T-lymphocytes levels was observed beginning from the 5th day after irradiation and continued for several weeks after radiation. (auth)

9546 DIFFERENT RADIOSENSITIVITY OF HEMATOPOIETIC CELLS IN CHICK EMBRYOS. Knezevic, Z. A.; Petrovic, N. V.; Radivojevic, D. V.; Milic, O. B. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). Strahlentherapie; 150: No. 1, 70-75(Jul 1975).

3 figs.; 1 tab.; 35 refs.

Embryos of different ages from 24th to 120th hour of incubation were irradiated with a dose of 700 R gamma rays at a rate of 50 R/min. After irradiation, peripheral blood was taken every 24 hours in order to control proliferation dynamics of megaloblastic and normoblastic cells. The results have shown that the cells of megaloblastic strain reduce much more the mitotic activity than those of normoblastic line. Although the cells of both strains after irradiation show depression in the proliferative activity, in transfer to polychromatophilic forms, megaloblasts disappear almost completely until normoblasts recover spontaneously. The nature of different radiosensitivity in these cell strains has been discussed. (auth)

9547 QUANTITATIVE CYTOCHEMICAL STUDIES OF THE RNA IN THE SPINAL CORD OF GAMMA-IRRADIATED MICE. Olkowski, Z. L.; McLaren, J. R. (Emory Univ., Atlanta, Ga. (USA). Radiation Therapy Div.). Strahlentherapie; 150: No. 1, 76-79(Jul 1975).

2 figs.; 14 refs.

Quantitative analysis of RNA content was carried out in the oligodendroglia apposed to motor neurons and oligodendrocytes located far from the perikaryons in the spinal cord of mice subjected to 630 rads of whole-body gamma irradiation. Decrease of relative RNA content in the glial cells apposed to the neuronal body in the irradiated animals 30 min to one hour after irradiation and the increase of RNA content in these cells two to eight hours after radiation was found. Glia located far from the perikaryons of motor neurons reacted with increase of RNA content 30 min after irradiation followed by a sharp decrease one hour later. This difference in the reaction of glia to whole-body irradiation may be due to different metabolic patterns between glia linked to neurons in neuroglial unit and glia located far from perikaryons. (auth)

9548 INVESTIGATIONS ON THE RELATIONS BETWEEN THE BIOCHEMICAL CHANGES IN THE BRAIN AND BEHAVIOR OF IRRADIATED RATS. Kocmierska-Grodzka, D.; Romatowska, A.; Szymanski, A. (Akademia Medyczna, Bialystok (Poland). Zaklad Farmakologii). Strahlentherapie; 150: No. 1, 102-108(Jul 1975).

4 figs.; 1 tab.; 38 refs.

The behavior of irradiated rats and biochemical changes in the brain tissue were investigated in the early period after whole-

body irradiation with the dose of 800 R. It was found that after exposition to x ray, psychomotor activity undergoes phasic modifications. Within the first day the behavioral activation was started, which was accompanied by the increase of hydroproteolytic and MAO activity in the brain. Simultaneously a decrease of serotonin and noradrenalin content in the brain stem was found in irradiated rats. On the second and third day of postirradiation syndrome the behavioral inhibition was observed. (auth)

9549 INVESTIGATIONS ON THE INFLUENCE OF AMINO-PROPYL-AMINOETHYL-PHOSPHOROTHIOIC ACID ON THE RADIO-IRON UTILIZATION AFTER A WHOLE-BODY IRRADIATION OF MICE IN THE SUBLETHAL DOSE RANGE. Moenig, H.; Seiter, I.; Kofler, E. (Freiburg Univ. (F. R. Germany). Inst. fuer Biophysik und Strahlenbiologie). Strahlentherapie; 150: No. 1, 44-50(Jul 1975). (In German).

1 fig.; 3 tabs.; 21 refs.

The effectiveness of the thiophosphate compound WR 2721 was investigated with regard to the radiosensitivity of x-irradiated female mice in the sublethal dose range of 50 to 150 R using the radioiron test (^{59}Fe). An increase of the radioresistance with regard to the radioiron uptake in young erythrocyte populations was obtained only beyond radiation doses of 75 R. In lower dose ranges the animals treated with thiophosphate became even more radiosensitive. At dose values of 100 R and 150 R dose reduction factors (DRF) of 1.3 and 1.5 respectively were obtained. These factors are considerably smaller than the DRF-values found for the survival rate at $LD_{50/30}$. A possible mechanism for this result may be due to the different dephosphorylation rate of the thiophosphate in various tissues, as described in literature. (auth)

9550 HYDRO-PROTEOLYTIC ACTIVITY IN RAT's PANCREAS AFTER IRRADIATION. Kocmierska-Grodzka, D.; Radwan, J. (Akademia Medyczna, Bialystok (Poland). Zaklad Farmakologii). Strahlentherapie; 150: No. 1, 80-86(Jul 1975).

3 figs.; 1 tab.; 46 refs.

Investigations were carried out on the problem of hydrolytic ability of rat's pancreas 24 h after whole-body irradiation with the single dose of 800 R and after fractionated irradiation (5 × 150 R). Besides kallikrein, enzymes of intracellular digestion (B-glucuronidase, acid phosphatase, cathepsin), and enzymes of intraluminal digestion (amylase, lipase) were chosen for examination. It was stated, that single irradiation evokes rather moderate changes in the activity of examined enzymes causing increase of catheptic and lipolytic activity and decrease in amylase activity accompanied by sharp increase of kallikrein activity in the tissue. Mechanical obstruction of biliopancreatic duct renders trend to decrease of enzymatic activity in almost all enzymes of irradiated group. After fractionated irradiation the general increase of hydroproteolytic activity (with one exception of pancreatic amylase) was stated. (auth)

9551 STUDIES ON THE EFFECT OF FENCHLORPHOS ON POSTIRRADIATION CHANGES OF SERUM PROTEINS AND NUCLEIC ACIDS CONTENT IN RAT LIVER. Mackowiak, J.; Wisniewski, K. (Akademia Medyczna, Bialystok (Poland). Zaklad Farmakologii). Strahlentherapie; 150: No. 1, 97-101(Jul 1975).

4 figs.; 20 refs.

The effects of Fenchlorphos on postirradiation changes of serum protein levels and nucleic acid content in rat liver were investigated. It was found that this compound significantly decreases postirradiation changes in serum proteins, properdin level and nucleic acid content in rat liver. An important role of these phenomena in radioprotective action of Fenchlorphos is suggested. (auth)

9552 EXPERIMENTAL INVESTIGATIONS ON POSSIBILITIES OF CHEMICAL RADIATION PROTECTION. Ritter, K. (Institut fuer Allgemeine und Experimentelle Pathologie der Bundeswehr, Mainz (F. R. Germany)). Wehrmed. Monatsschr., No. 11, 337-341(1973). (In German).

22 refs.

The radioprotective effect of the sulphhydryl compounds N-acetyl-homocysteine-thiolactone and cysteine in combination with fructose (Reducdyn(R)) at various high radiation doses, different doses of the protective chemical, and varying times of application before and after irradiation was investigated in animal experiments. Altogether, 540 mice were subjected in groups to whole-body irradiation with 500, 1,000, and 2,000 R, doses of 0.1, 0.25, 0.5, and 1.0 ml Reducdyn(R) being injected intraperitoneally at each dose. In the case of animals irradiated with 1,000 R these different dosages of the protective chemical were given immediately before and 6, 12, 24, and 48 hours before and after the irradiation. The results showed that the effect of the protective substance decreased with increasing radiation dose, and was directly dependent on the dosage of the substance. A significant radioprotective effect could be domonstrated both with the prophylactic use of Reducdyn(R) 48 hours before irradiation and also 24 hours after exposure. The utilization of this type of chemical radioprotective substance is possible when exploding nuclear weapons or in accidents in nuclear engineering establishments. (auth)

9553 ANOREXIA IN RATS AFTER PROTRACTED WHOLE-BODY IRRADIATION WITH LOW DOSES. Schraub, A.; Sattler, E. L.; Doell, G.; Kindt, A. (Giessen Univ. (F. R. Germany). Strahlenzentrum; Giessen Univ. (F. R. Germany). Inst. fuer Biophysik). Strahlentherapie; 150: No. 1, 87-90(Jul 1975). (In German).

4 figs.; 6 refs.

In our experiments, carried out hitherto, concerning the effect of incorporated and radioactive substances, weight behavior and food uptake have proved to be a sensitive test. With regard to these experiments and the half-life of the radionuclides used, it is reported about trial series in Wistar rats. These rats were applied, with Co-60 gamma irradiation, different whole-body doses protracted over 48 hours. A total of 32 groups of experimental animals (20 animals each) was exposed to irradiation doses of lethal, medium lethal, and sublethal ranges, control and pseudo-irradiation series included. The experiments were carried out under observance of constant irradiation and attitude conditions, night and day changes, as conditioned by the season, included. Even in the inferior sublethal range (12 to 24 R), a significant trend of decreased food uptake is registered. This trend remains for a short period after the end of irradiation, but then it returns to normal conditions. Furthermore, a new decrease with subsequent increase seems to become evident— about ten days after termination of the radiotherapy (especially after several hundred R); report about these items will be made later on. (auth)

9554 EFFECTS OF LEVAMISOLE ON IN VIVO AND IN VITRO MURINE HOST RESPONSE TO SYNGENEIC TRANSPLANTABLE TUMOR. Fidler, I. J. (Univ. of Pennsylvania, Philadelphia); Spitler, L. E. J. Natl. Cancer Inst.; 55: No. 5, 1107-1112(Nov 1975).

The effects of levamisole were studied in vivo and in vitro on two murine tumors, B16 melanoma and adenocarcinoma 15091, syngeneic to the mouse strains used. Administration of levamisole before tumor transplantation enhanced the early appearance of neoplasms but did not affect the overall incidence or course of tumor growth as compared with that observed in controls given saline injections or animals given levamisole with lethally-irradiated tumor cells. Administration of the drug 1 day before iv injection of tumor cells significantly reduced the incidence of pulmonary nodules, but if the drug was given 3 or 5 days before tumor challenge, the incidence of nodules was increased. Lymphocytes or macrophages from normal mice given levamisole had no effect on tumor cells in vitro, whereas lymphocytes incubated with levamisole in vitro enhanced tumor cell growth. When lymphycytes and tumor cells were mixed in vitro, lymphycytes from animals treated with the drug formed larger multicell clumps with tumor cells than did those from normal controls. We concluded that levamisole did not protect the mice against the tested tumors. (auth)

9555 DATA ON THE ACTION SPECTRUM FOR ULTRAVIOLET CARCINOGENESIS. Freeman, R. G. (Baylor Coll. of Medicine, Houston, TX). J. Natl. Cancer Inst.; 55: No. 5, 1119-1122(Nov 1975).

When 300, 310, or 320 nm monochromatic energy was given to albino mice in amounts proportional to its erythemal effectiveness, skin tumors developed on the exposed ears of the mice at approximately the same time and the same rate in all three groups. Thus the long wavelength limit of the carcinogenesis action spectrum paralleled that of the erythema action spectrum. No tumors were found in mice exposed to a 290-nm uv wavelength nor in those exposed to low dosages at 310 nm. All tumors observed in the group exposed to 300 nm were squamous cell carcinomas; three sarcomas and five squamous cell carcinomas were seen with the more penetrating doses of a 310-nm uv wavelength. (auth)

9556 NEOPLASTIC AND LIFE-SPAN EFFECTS OF CHRONIC EXPOSURE TO TRITIUM. II. Rats Exposed in Utero. Cahill, D. F. (National Environmental Research Center, Research Triangle Park, NC); Wright, J. F.; Godbold, J. H.; Ward, J. M.; Laskey, J. W.; Tompkins, E. A. J. Natl. Cancer Inst.; 55: No. 5, 1165-1169(Nov 1975).

A study was conducted to determine the effects on neoplasia incidence and life-span of exposure in utero to a major environmental radionuclide, Sprague-Dawley rats were continuously exposed to tritiated water (HTO) from conception through birth in doses of 0, 1, 10, 50, and 100 mu Ci HTO/ml body water. HTO administration was terminated at birth. Calculated cumulative doses during gestation were approximately 0, 6.6, 66, 330, and 660 rads of total body irradiation. Under these exposure conditions,

the two highest doses resulted in sterile offspring. Animals surviving through 30 days postnatally were defined as the study population and observed until their deaths. Intrauterine exposures to doses up to 66 rads had no significant effects on either sex with respect to lifespan, overall neoplasia incidence, incidence rate, or onset of mammary fibroadenomas. Females exposed to 330 or 660 rads were sterile and had lower incidence rates of mammary fibroadenomas than did controls; at 660 rads females had a lower incidence of overall neoplasia and reduced mean lifespans. Sterile male offspring had reduced mean longevity after irradiation at 660 rads. Regardless of dose group, females had significantly higher incidences of neoplasia and longer life-spans than males. (auth)

9557 METRONIDAZOLE: EFFECT ON RADIOSENSITIVITY OF TUMOR AND NORMAL TISSUES IN MICE. Stone, H. B.; Withers, H. R. (Univ. of Texas, Houston). J. Natl. Cancer Inst.; 55: No. 5, 1189-1194(Nov 1975).

Local control of a mammary carcinoma in air-breathing C3H mice was enhanced by giving metronidazole before radiotherapy. When 0.5 to 1.0 Mg metronidazole/g body weight was given ip 10 minutes before irradiation, the dose required for local control of 50 percent of the tumors (TCD50) was reduced by a factor of 1.37 to 1.38. The TCD50 was reduced by a factor of 1.48 to 1.50 when tumors were irradiated 30 to 60 minutes after 1.0 mg/g. Metronidazole alone, at a dose of 1.0 mg/g, only slightly inhibited tumor growth. The acute skin response of the leg, as determined by the radiation dose required to produce complete moist desquamation in 50 percent of the animals (DD50), was enhanced by a factor of 1.26 when mice were irradiated 10 minutes after a dose of 1.0 mg metronidazole/g. Clonogenic cells in the jejunal epithelium were not sensitized after metronidazole administration in either air-breathing mice or those irradiated in O_2 30 pounds per square inch, but the drug appeared to exert a slight protective effect at higher doses of radiation. (auth)

9558 HUMAN STUDIES WITH "HIGH DOSE" METRONIDAZOLE: A NON-TOXIC RADIOSENSITIZER OF HYPOXIC CELLS. Deutsch, G. (Mount Vernon Hospital, Northwood, Eng.); Foster, J. L.; McFadzean, A.; Parnell, M. Br. J. Cancer; 31: No. 1, 75-80(Jan 1975).

The serum concentrations of the radiosensitizer metronidazole have been determined in mice for both oral and intraperitoneal doses of the drug and these have been related to radiosensitization studies in murine tumor systems. In preliminary work before a possible clinical trial the serum metronidazole concentration/time curves have been determined in seven patients using single doses of metronidazole of up to 15 g. The data suggested that a linear relationship exists between the metronidazole dose expressed in mg/kg and the peak serum concentration. The possibility of achieving radiosensitization of tumors in patients after tolerable doses of metronidazole is discussed in relation to enhancement ratios determined for in vitro and in vivo system. It is concluded that predictions from in vitro systems give values that are probably too optimistic. (auth)

9559 RESPONSE OF A RAT BRAIN TUMOR TO IRRADIATION WITH ACCELERATED NEON IONS. Leith, J. T.; Arcellana, V.; Lyman, J. T.; Wheeler, K. T. (Univ. of California, Berkeley). Int. J. Radiat. Biol.; 28: No. 1, 91-97(Jul 1975).

An investigation into the effects of single doses of plateau-ionization-region accelerated neon ions on the cellular survival characteristics of a rat brain tumor has produced data on the survival of oxic and hypoxic tumor cells. A direct estimation of the fraction of clonogenic cells was made by removing the tumor and then dissociating it enzymatically into single cells. These single cells were then grown in tissue culture to form colonies. The rats' brains were injected with 4×10^4 gliosarcoma cells, and irradiations were performed 17 to 18 days after the injection. Survival curves for the responses of oxic and hypoxic intracerebral tumor cells to either 230 kV x rays or 375 MeV/nucleon neon ions gave values at 2.1 for the in vivo x-ray oxygen enhancement ratio, neon RBE values of 1.4 for oxic solid-tumor cells and 1.9 for hypoxic solid-tumor cells, and an in vivo neon ion oxygen enhancement ratio of approximately 1.6. The trend in the difference in o.e.r. as a function of LET is compared with other workers' results. (UK)

9560 RADIATION EFFECTS ON RAT TESTS. V. Studies on Lysosomal Enzymes (Acid Phosphatase and Acid DNAse) and Their Physiological Significance Following Partial Body Gamma Irradiation. Gupta, G. S.; Bawa, S. R. (Punjab Univ., Chandigarh, India). J. Reprod. Fertil.; 44: No. 2, 223-233(Aug 1975).

Acid phosphatase is present in the nucleus and cytoplasm of cells in the seminiferous tubules and the interstitium of rat testes. The effect of irradiation on acid phosphatase is dependent on the environmental temperature and the dose of irradiation. It appears that initial rise in the enzyme at a low radiation dose and a high environmental temperature or at a high dose and low temperature is associated with a lysosomal breakdown of the germinal cells of the testes. A decrease in acid phosphatase in the advanced stages of radiation injury is a secondary radiation effect which may lead to decreased metabolic synthesis of phosphate esters owing to the unavailability of orthophosphate in the testicular tubules. The reduced acid phosphatase activity can be detected in the seminiferous tubules, suggesting that the enzyme activity is related to the state of the germ cell population. An initial increase in acid phosphatase is matched by an initial rise in acid DNAse within hours of irradiation, further suggesting that there is radiation interaction with the cells of the germinal epithelium. The enhanced activity of DNAse following a 2nd week of irradiation at 2000 R confirms the phagocytic activity of the non-germinal cells. (auth)

9561 X RAY IRRADIATION AS A FACTOR EVINCING CEREBRAL EPILEPTIFORM PREPAREDNESS. Eliner, G. I.; Stepanov, A. I.; Filatov, P. P. (Leningrad Scientific-Research Inst.). Zh. Nevropatol. Psikhiat.; 75: No. 3, 394-396(1975). (In Russian)

The authors conducted an experimental study on rabbits of the chinchilla type. It was demonstrated that there was a regular increase of epileptiform readiness of the brain as the doses of x-ray irradiation grew in the range of 20 to 400 R. This tendency was shown by a methodological test which consisted of a study of the frequency of reconstruction in the brain bioelectric activity during a hypercapnic loading against the background of metrasole. (auth)

9562 GAMMA IRRADIATION OF MAMMALIAN BEATING HEART CELLS IN VITRO. Effects on Cellular Function. Lampidis, T. J. (Harvard School of Public Health, Boston); Weichselbaum, R. R.; Little, J. B. Int. J. Radiat. Biol.; 28: No. 1, 99-102(Jul 1975).

Measurements of mitotic viability as determined by clonogenic survival techniques cannot be used to assay the functional effects of radiation on post-mitotic cells. The ability of myocardial cells of new-born rats to continue to beat rythmically in vitro after receiving high acute doses of ^{60}Co gamma radiation (0 to 100,000 rad) has therefore been studied. Heart muscle cells do not divide in vitro and the effects of vascular damage on an organ are also eliminated. The results demonstrated that post-mitotic heart cells were functional at doses of more than ten times that needed to reduce a dividing population to 10^{-3} survival, and loss of rythmicity after gamma irradiation occurred much earlier than the loss of the intrinsic ability of these cells to contract spontaneously. The arrhymicity thus appears to be a precursor to loss of beating in this in vitro system. (UK)

9563 RADIOPROTECTION OF LIPOGENESIS FROM GLUCOSE (U-^{14}C) AND ACTIVITIES OF PYRIDINE NUCLEOTIDE DEHYDROGENASES IN LIVER OF GAMMA-IRRADIATED FEMALE RATS BY CYSTAMINE. Ramanathan, R.; Misra, U. K. (Delhi Univ.). Int. J. Radiat. Biol.; 28: No. 1, 35-43(Jul 1975).

Whole-body gamma irradiation (1200 R) of female rats significantly increased liver glycogen and incorporation of glucose (U-^{14}C) into liver fatty acids. Administration of cystamine before irradiation protected the enhanced lipogenesis from glucose (U-^{14}C), but afforded only a partial protection of liver glycogen levels. Irradiation significantly decreased the activities of liver pyruvate kinase and isocitrate dehydrogenase, and this decrease was not prevented by the administration of cystamine before irradiation. A significant increase in the activity of liver malate dehydrogenase (dehydrogenating) was noted in irradiated rats, which was not prevented by the administration of cystamine before irradiation. Irradiation did not affect the activities of combined hexose monophosphate pathway dehydrogenases and of malate dehydrogenase (decarboxylating). (auth)

9564 ADRENOCORTICOTROPIC (ACTH) CELLS OF RATS AFTER HEAD IRRADIATION. Pantic, V.; Hristic, M. (Biological Inst., Belgrade). Int. J. Radiat. Biol.; 28: No. 1, 53-60 (Jul 1975).

The heads of intact rats and of rats 15 days after adrenalectomy were irradiated with 1200 R. Some of the adrenalectomized animals with irradiated heads were treated with 5 mg of deoxycorticosterone acetate. In adrenocorticotropic cells of adrenalectomized rats 15 and 30 days after irradiation, the decreased amount of the granular endoplasmic reticulum and the Golgi regression implied a considerably decreased protein synthesis. The finding of an increased number of granules and of granules larger than normal suggested that they are the result of slowed down transport and secretion of the products of these cells' activities. After head irradiation an increased number of degenerative cells was evident in the pituitary of both intact and adrenalectomized rats. The degree of the degenerative changes and the number of degenerative cells was higher 30 than 15 days after irradiation

and both were decreased if the adrenalectomized rats were treated with deoxycorticosterone acetate. (auth)

9565 INFLUENCE OF RAT BLOOD ON RADIATION PROTECTION OF MAMMALIAN CELLS BY CYSTEAMINE AND CYSTAMINE IN VITRO. Grant, G. A. (Defence Research Establishment, Ottawa); Vos, O.; Budke, L. Int. J. Radiat. Biol.; 28: No. 1, 45-51(Jul 1975).

The protective effect of cysteamine and cystamine on T-cells in normal growth-medium was studied in the presence of whole rat blood (WRB). The protective effectiveness of both agents was increased by the addition of WRB, but much less so on the activity of cystamine. In the presence of WRB a dose-reduction factor of 1.5 was obtained at the low concentration of 0.05 mM cysteamine. The increase in protection was not due to induction of anoxia or to a release of glutathione from the rat red cell. The increase in protection may have been due to protector RS-radicals reacting with rat red cells. (auth)

9566 IMPAIRMENT OF THE BACTERICIDAL ACTIVITY OF MURINE MACROPHAGES FOLLOWING X IRRADIATIONS. Gallily, R.; Zylberlicht, D. (Hebrew Univ., Jerusalem). Immunochemistry; 12: No. 6/7, 611-614(1975).

Bactericidal activity of normal and irradiated murine macrophages was analyzed by assaying the incorporation of ^{3}H-thymidine by phagocytized Staphylococcus albus autoradiographically. Following sublethal or lethal x irradiation, murine macrophages lost some of their bactericidal capacity. While 16% of the intracellular Staphylococci were labelled in normal macrophages, 47 and 52% of the engulfed bacteria were labelled in 550 R and 800 R irradiated macrophages, respectively. This impairment of bactericidal function might be responsible for post irradiation infections and bacteremia observed in x-irradiated animals or humans. (auth)

9567 RADIATION-INDUCED SYNCHRONIZATION OF THE WALKER CARCINOMA IN VIVO. Linden, W. A.; Zywietz, F.; Baisch, H.; Skiba, J. (Hamburg Univ.). Eur. J. Cancer; 11: No. 6, 419-423(Jun 1975).

Exponentially growing Walker tumors of a weight of 1.0 ± 0.3 g were irradiated at a 200 kV_p X-ray unit with single and fractionated doses ranging from 50 to 900 rads. The influence of the radiation on the cell cycle of the carcinoma was studied using a pulse-cytophotometer. By this method DNA distribution patterns of the tumor cells are obtained. The mathematical analysis of these DNA distributions using a computer program gives the percentage of cells belonging to the various phases of the cell cycle. The results show a reversible accumulation of cells in the G_2-phase and a partly synchronous passage of cells from G_2-phase into mitosis and G_1-phase. With the highest dose applied, the fraction of cells in G_2 could be increased from 14 to 48%. The degree of synchrony obtained is compared with the values determined after chemical treatment in vivo. (auth)

9568 RESTING STAGES OF THE JB-1 ASCITES TUMOR IN THE IRRADIATED MOUSE. Bichel, P. (Radiumstationen for Jylland, Aarhus, Denmark); Dombernowsky, P. Eur. J. Cancer; 11: No. 6, 425-431(Jun 1975).

In previous investigations of the JB-1 ascites tumor the increasing fractions of resting cells with G_1 DNA content (Q_1 cells) and of resting cells with G_2 DNA content (Q_2 cells) with increasing age and mass of the tumor were demonstrated. The present study of the JB-1 ascites tumor in immuno-suppressed mice (subjected to 400-rad whole-body irradiation 24 hr before inoculation) was undertaken in order to investigate the role of a possible immune reaction against the tumor cells for the accumulation of these Q_1 and Q_2 cells. The experimental data, viz. growth curve, and continuous labelling experiments combined with cytophotometry, showed, first, identical growth of the tumors in the irradiated and non-irradiated mice and, secondly, preserved accumulation of Q_1 and Q_2 cells in the irradiated mice. These non-cycling cells re-entered the cell cycle after removal of most of the tumor in the plateau phase, or after transplantation of cells from plateau tumors to new hosts. The present results, which are identical with those previously obtained with the tumor carried by normal mice, lend further support to the assumption that the accumulation of non-cycling cells in the aging JB-1 ascites tumor is of a non-immunological nature. (auth)

9569 EFFECT OF HUMAN α_2-MACROGLOBULIN ON THE RESTORATION OF HUMORAL RESPONSIVENESS IN X-IRRADIATED MICE. Tunstall, A. M.; James, K. (Edinburgh Univ.). Clin. Exp. Immunol.; 21: No. 1, 173-180(Jul 1975).

The effect of human α_2-macroglobulin on the recovery of the humoral immune response in x-irradiated mice has been assessed by measurement of antibody-forming cells in the spleen 5 days after challenge with sheep erythrocytes. The capacity of this protein to promote the recovery of immune responsiveness was variable, and appeared to be influenced by the strain and sex of the mice, and the dose of the α_2M given. (auth)

9570 CHANGES IN SENSITIVITY TO RADIATION AND TO BLEOMYCIN OCCURRING DURING THE LIFE HISTORY OF MONOLAYER CULTURES OF A MOUSE TUMOR CELL LINE. Twentyman, P. R.; Bleehen, N. M. (Middlesex Hospital, London). Br. J. Cancer; 31: No. 1, 68-74(Jan 1975).

The response to x radiation and to bleomycin has been measured at a number of times during the life of monolayer cultures of EMT6 mouse tumor cells. Little change in radiation sensitivity was seen at any time and no loss of the shoulder to the survival curve occurred. Cultures in early plateau phase (where a considerable amount of cell proliferation is balanced by cell loss) showed a reduced sensitivity to bleomycin when compared with cells in exponential growth. However, after a longer period in plateau phase, when proliferation had virtually ceased, the sensitivity became greater than that of exponential phase cells. These findings are discussed with reference to the conflicting results of other workers. (auth)

9571 MODEST RADIOSENSITIZATION OF SOLID TUMORS IN C3H MICE BY THE HYPOXIC CELL RADIOSENSITIZER NDPP. Sheldon, P. W.; Smith, A. M. (Mount Vernon Hospital, Northwood, Eng.). Br. J. Cancer; 31: No. 1, 81-88(Jan 1975).

The x-ray dose required to cure half the mice bearing first generation transplanted mammary carcinomata 150 days after irradiation was determined. NDPP proved to be a relatively poor radiosensitizer in mice, for although a maximum enhancement ratio of 1.3 was obtained when x rays produced from a 1.4 MeVp electron accelerator were given between 10 and 17 min after the administration of NDPP, this was at a drug concentration sufficient to cause marked kidney abnormalities in 5 to 10% of the mice. (auth)

9572 DISTRIBUTION OF ^{99m}Tc-PERTECHNETATE IN HAMSTER TUMOR TISSUE. Rose, C. (McMaster Univ., Hamilton, Ont.). Int. J. Nucl. Med. Biol.; 2: No. 3, 142-144 (Jul 1975).

The uptake of TcO_4^- (containing Tc-99m) as compared with $^{82}Br^-$ was investigated in hamster tumor (HTC) cells grown in tissue culture and also in tumors produced by injecting HTC cells into hamsters. The in vitro studies showed that TcO_4^- was present in the cell suspensions to an extent greater than $^{82}Br^-$. A brief washing of the cells in phosphate buffer saline (PBS) pH7.4 removed most of this excess TcO_4^-, indicating that loose binding of TcO_4^- occurs with some component of the cell surface in vitro. In the whole animal experiments it was found that there were higher values of both TcO_4^- and $^{82}Br^-$ concentrations in tumor tissue than in muscle. Under these conditions, loose binding of TcO_4^- did not contribute to the concentration of TcO_4^- in tumor tissue. These results are discussed in relation to brain tumor visualization of Tc-sodium pertechnetate scans. It is suggested that only tumor vascularity, the permeability of the blood/tumor ECF barrier and the size of the tumor ECF can determine the concentration of TcO_4^- in tumor tissue, since the pertechnetate seems to be located in the extracellular space. (UK)

9573 LEUKEMIA IN AKR MICE AFTER IRRADIATION AND MARROW TRANSPLANTATION: DEVELOPMENT OF A MODEL FOR LEUKEMIC TRANSFORMATION. Allen, J. W. Pittsburgh; Univ. of Pittsburgh (1974). 97p. University Microfilms Order No. 75-19,552.

Thesis (Ph. D.).

Cytogenetic studies have demonstrated leukemic transformation of normal donor cells in two lymphoblastic leukemia patients treated with lethal irradiation followed by marrow engraftment. In the present study, a mouse model was developed for studying factors effecting leukemic relapse and transformation of donor marrow cells. Leukemic and pre-leukemic AKk mice (6½–7½ months old) served as recipients of the lethal irradiation and donor cells. These animals develop Gross virus associated leukemia (thymic lymphoma) between 6 and 13 months of age. Various criteria (lymph organ enlargement, chest swelling, appearance, weight) thought most likely to reflect leukemic status of the recipient mice were evaluated in the hope of their having some prognostic value. These criteria did not predict exact survival time; however, a combined score derived from evaluation of spleen, brachial nodes, and inguinal nodes was useful for distinguishing between animals destined to die before or after 30 days. Syngeneic marrow donors were normal 2 month old AKR and normal 2 month old AKR/T1 Ald mice, the latter of which possess cytogenetic markers (two large metacentric chromosomes). Allogeneic marrow donors were normal CBA/T6T6 mice, which are matched with AKR mice for the "k" allele at the H-2 histocompatibility locus, and also possess cytogenetic markers (two unusually small

chromosomes). All such treated mice and their treated and untreated controls were followed for survival and leukemic incidence. In addition, some groups which had received AKR/T1 Ald or CBA/T6T6 cells were sacrificed upon diagnosis of leukemia and analyzed with regard to patterns and proportions of donor and/or host cells present. Numerical and obvious structural abnormalities were also evaluated. (Disser. Abstr.)

9574 RESPONSE OF SPERMATOGONIA OF THE MOUSE TO HYCANTHONE: A COMPARISON WITH THE EFFECT OF GAMMA RAYS. Oakberg, E. F. (Oak Ridge National Lab., TN). Basic Life Sci.; 4: 197-207(1974).

The stem cell of the seminiferous epithelium has been identified as a type A spermatogonium with an oval, darkly staining nucleus in cross-sections and a spherical or ovoid shape in tubule whole mounts. The stem spermatogonia occur as single, isolated cells, in contrast to the groups of differentiating spermatogonia which form "chains" of cells connected by cytoplasmic bridges. Some stem cells have very long cell-cycle times (8+ days in the mouse); others have cycles only slightly longer than the 26 to 28 h characteristic of differentiating spermatogonia. The spermatogonial stem cells are further characterized by high resistance to radiation and noxious agents, in general. The cell-specific response characteristic of radiation also was observed after hycanthone injection for A_3, A_4, and intermediate (In) spermatogonia. The killing of A/sub s/ and A_1 spermatogonia by hycanthone, however, was much less than would have been predicted for radiation doses giving comparable survival for A_3, A_4, and In spermatogonia. Dose, route of administration (i.p. or i.m.), time of observation, and cell stage all were important variables in the response to hycanthone. Whereas the use of a specific cell type, time of observations, end point, and dose may be useful in demonstrating the action of a chemical, extreme care must be used in estimating possible hazards to the organism from such information. Failure to observe mutagenicity of hycanthone in the mouse has raised the obvious question of whether the drug reaches the germ cells. The cytotoxic effect demonstrated by the data presented here indicates that either hycanthone or toxic metabolites of the drug do reach the spermatogonia in significant quantities. (auth)

9575 BIOMEDICAL PROGRAM LEADING TO THERAPEUTIC TRIALS OF PION RADIATION AT LOS ALAMOS. Kligerman, M. M.; Knapp, E. A.; Petersen, D. F. (Univ. of New Mexico, Albuquerque). Cancer; 36: No. 5, 1675-1680 (Nov 1975).

Hypoxia and variations in cell cycle phase protect tumor cells being treated with x rays or gamma rays (cobalt). Heavy particles can overcome these protective effects, because of the dense ionization they deposit in tissues. Pions (negative pi mesons) can be directed to and stopped in a specific area, where they are captured by the nuclei of atoms, rendering the nuclei unstable. The nuclei disintegrate, releasing densely ionizing radiation. By confining the dense ionization to the tumor-bearing volume, pions have the potential of increasing the tolerance of the area under treatment to radiation, thus increasing the probability of destroying the tumor. A special channel at the proton factory at the Los Alamos Scientific Laboratory is producing pions for biomedical research. Considerable physical dosimetry has been completed. Cellular studies are under way to provide depth-dose-biological-effect curves. Animal studies will provide information on acute and late effects, which will permit the safe application of pions to a series of anatomical sites established by protocols for radiotherapy clinical trials. (auth)

9576 QUALITATIVE CHANGES OF HAEMOGLOBIN IN RATS SUBJECTED TO WHOLE-BODY IRRADIATION WITH 600 R. Pospisil, J.; Zitko, M.; Prouza, Z.; Dienstbier, Z. (Karlova Univ., Prague). Sb. Lek.; 77: No. 3, 85-91(1975). (In Czech)

In rats subjected to whole-body irradiation with x-rays — 600 R, the authors observed a marked decline in the ratio of acid resistent haemoglobin on the second and fourth day after exposure, subsequently during radiation sickness an increased ratio of acid resistent haemoglobin was found which was most marked on the 21st day after exposure. The amount of alkali resistent haemoglobin declined markedly on the first and second day after whole-body irradiation. The ratio of methaemoglobin was significantly raised 14 and 21 days after irradiation. (auth)

9577 METHODOLOGICAL BASES OF ANIMAL EXPERIMENTS USING IONIZING RADIATION. Gajewski, A. K.; Rozycki, Z. (Zakladu Ochrony Radiologicznej Radiobiologii Panstwowego Zakladu Higieny, Warsaw). Rocz. Panstw. Zakl. Hig.; 25: No. 5, 583-595(1974). (In Polish).

On the basis of investigations and data from the literature the authors discuss the effects of factors connected with physical properties of radiation and the effects of factors connected with the biological properties of the organism on the results, accuracy and reproducibility of radiobiological experiments. In the last part of the work the role of factors connected with the method of experiments is discussed. (auth)

9578 SCREENING SYSTEM TO DETERMINE INHIBITION OF SPECIFIC ENZYMES OF THE SEMICONSERVATIVE DNA-SYNTHESIS AND DNA-REPAIR REPLICATION. Kocsis, F.; Klein, W.; Altmann, H. (Forschungszentrum, Seibersdorf, Austria). Z. Naturforsch., C.; 28: No. 1/2, 131-135(1973). (In German).

To observe the influence of substances on specific enzymes of the semiconservative DNA-synthesis and DNA-repair replication a screening system was developed which represents an extensive modification of known papers. Optimal conditions were found after comprehensive investigations. The detergent Tween 80 and the antileukemic drug cis-platinum(II)diamminodichloride were used as test substances. (auth)

9579 EFFECT OF IRRADIATION ON THE PHENOMENON OF ALLOGENOUS INHIBITION. Lemeneva, L. N.; Chertkov, I. L. (Central Inst. of Hematology and Transfusion, Moscow). Probl. Gematol. Pereliv, Krovi; 8: 45-52(1974). (In Russian).

Preliminary irradiation of recipient mice (CBA × C_{56}BL)F_1 by x- and γ-rays led to a considerable weakening of the phenomenon of repression of colony-forming units (CFU) after transplantation to them of bone marrow of C_{57}BL mice. The effect of preliminary irradiation was specific, i.e., it did not influence the number of colonies produced by syngenous bone marrow. Reduction of repression of the CFU begins 6 days after the irradiation, reaches the maximum in 8 to 15 days, and diminishes and disappears in one and a half to two months. Depression of CFU by preliminary irradiation was realized irrespective of the source of CFU (adult bone marrow or embryonic liver) or their condition (nonproliferating CFU of the bone marrow in stable condition, or CFU of early radiation chimerae). (auth)

9580 CHANGE IN THE SURVIVAL HALF-TIME OF ERYTHROCYTE DURING ACUTE RADIATION SICKNESS. Prouza, Z.; Pospisil, J.; Dienstbier, Z. (Karlova Univ., Prague). Sb. Lek.; 77: No. 3, 78-84(1975). (In Czech).

In rats exposed to 600 R of x rays the authors found on the basis of labelling of red cells in vivo with ^{51}Cr significant changes in the survival half-time of red cells. This value was reduced during the radiation sickness. The lowest value was obtained when the red cells were labelled one day before irradiation. This means that normal values were nearly recovered during the period from 0 to 28 days after irradiation. (auth)

9581 VITAMIN B_{12} ABSORPTION IN X-IRRADIATED RATS. D'Souza, D. W.; Vakil, U. K.; Sreenivasan, A. (Bhabha Atomic Research Centre, Bombay). Environ. Physiol. Biochem.; 5: 37-48(1975).

The effect of whole-body exposure of rats to a sub-lethal dose (400 rad) of x-rays on the absorptive capacity of intestinal mucosal cells for vitamin B_{12} has been studied. The rate of absorption of vitamin B_{12} from the intestinal loops is decreased in x-irradiated rat. Inclusion of gastric juice from normal rat does not improve the rate. A severe interference in the absorption and retention of orally fed (^{57}Co)-B_{12}, as evidenced by low serum levels, decreased organ uptake and increased excretion, is observed. However, when the vitamin is administered intraperitoneally, its uptake by organs is not affected in the irradiated animal. This suggests that the observed morphological degeneration of mucosal cells in x-irradiated rats is the main reason for the malabsorption of vitamin B_{12}. Atrophy of intestinal cells in the protein-fasted rat accentuates the adverse effects of radiation. A sharp drop in viable intestinal flora is observed within 24 h post-irradiation, but there is an increase after 3 days. (auth)

9582 TOTAL IRRADIATION EFFECTS ON BONE RESORPTION CAUSED BY ORTHODONTIC MOVEMENT. Ubios, A. M. (Univ. de Buenos Aires); Parodi, R. J.; Cabrini, R. L.; Lopez Otero, R. Ortodonica; 38: No. 75, 5-12(May 1974). (In English and Spanish).

We reported earlier that irradiation neither stimulated the resorption mechanism nor the formation of osteoclasts. These findings indicate that there was a great loss of interradicular bone in animals subjected to both variables, i.e., orthodontic movement and irradiation. (auth)

9583 LONG-TERM EFFECTS OF IONIZING RADIATION ON THE RAT SPINAL CORD: INTRAMEDULLARY CONNECTIVE TISSUE FORMATION. Gilmore, S. A. (Univ. of Arkansas, Little Rock). Am. J. Anat.; 137: No. 1, 1-17(May 1973).

Light microscopy was used to evaluate the effects of ionizing radiation on spinal cords of rats irradiated when three days of age and killed at intervals up to 28 months after irradiation. The amounts of x-rays administered (2,000 R; 1,000 R; 500 R) were those which had been demonstrated by short-term studies to cause either no histopathologic changes or only transient, reparable

alterations. The most significant and previously unreported finding was the development, usually restricted to the gray matter, of elongated, spindle-shaped cells that produce prodigious amounts of fibers clearly demonstrated by the Wilder's reticular stain. In cases where extensive cellular development had occurred, these cells were oriented around the perikarya of the large ventral motor neurons and formed a well-developed capsule of reticular fibers. This phenomenon occurred more frequently in rats receiving the greater amounts of radiation and killed 12 months or more after exposure. The other observation of interest was the development of lesser amounts of connective tissue-producing cells in the dorsal gray matter, where these cells were seen initially in the substantia gelatinosa. The significance of these changes is discussed in relation to previously reported long-term effects of ionizing radiation on the central nervous system. (auth)

9584 ESTIMATE OF THE PATIENT RISK IN CYCLOTRON NEUTRON RADIOTHERAPY USING MOUSE TESTES AS A BIOLOGICAL TEST SYSTEM. Geraci, J. P.; Jackson, K. L.; Thrower, P. D.; Fox, M. S. (Univ. of Washington, Seattle). Health Phys.; 29: No. 5, 729-237(Nov 1975).

Decrease in mouse testes DNA 28 days after exposure has been used to biologically characterize the University of Washington fast neutron radiotherapy facility. The cyclotron fast neutron RBE for testes damage was found to be independent of depth in a tissue equivalent absorber. However, the RBE increased with decreasing field size and was greater in the penumbra as compared to the primary beam. The rad dose in the shielded region of the facility was 2.8% of the primary beam rad dose with a patient phantom in the primary beam. Under these conditions, the average RBE for testes damage was 4.9 in the shielded region as compared to 3.0 in the primary beam. Measurement of Na activation at depths in an absorber indicated that neutrons in the shielded region are fairly penetrating. Based on these and other data, an estimate of the lethal carcinogenesis risk to a patient population receiving neutron therapy is 2% over a 15-yr period and 18% over a 30-yr period post-therapy. (auth)

9585 TARGET-CELL CHARACTERIZATION OF RAUSCHER LEUKEMIA VIRUS IN VIVO. Seidel, H. J. (Univ. of Ulm, Switzerland). Bibl. Haematol.; 39: 935-942(1973).

Based on a pancytopenia after Rauscher virus infection of CBA mice and a decrease of the CFU content of the spleen and bone marrow after 2 days the hypothesis was set up, that the target cell for the Rauscher virus would be the hemopoietic stem cell. This was proven by the detection of the number of CFU/TCFUs of the spleen of mice 5 days after infection under different conditions. The TCFUs could be demonstrated even in polycythemic mice which do not develop spleen tumors. Elevated TCFU numbers were seen after infection of mice after bleeding or injection of endotoxin. Both pretreatments lead to an expansion of the CFU compartment in normal mice. A decrease of this compartment by irradiation decreased the onset of Rauscher disease and the development of TCFUs. No TCFUs were found in Myleran-treated animals, which possessed no transplantable stem cells. These findings are taken as evidence for the hypothesis that stem cells act as target cells for the Rauscher virus. (auth)

9586 COMPARISON OF RADIATION RESPONSE, CYANIDE, TOXICITY, AND SULFUR TRANSFERASE ACTIVITY IN NATIVE NORTH AMERICAN RODENTS. O'Farrell, T. P.; Dilley, J. V. (Battelle Pacific Northwest Labs., Richland, WA). Comp. Biochem. Physiol.; 50B: 443-447(1975).

Nine species of rodents representing three Families were exposed to ionizing radiation or potassium cyanide to determine whether sensitivity to KCN might be used as an index to radiation response of the species, and to document the comparative responses of the species to the stresses. There was a twofold variation between the responses of the most sensitive, Oryzomys palustris (525 rad), and the most resistant species, Perognathus longimembris (1094 rad), following radiation treatment. There was no apparent relationship between radiation responses and taxonomic affinity or adaptation to high altitude. There was a taxonomic ordering of responses to cyanide with members of the Family Heteromyidae most sensitive (4 mg/kg), Muridae intermediate in response, and members of the Family Cricetidae most resistant (9·6 mg/kg). There was no correlation between radiation resistance and KCN toxicity in the Families Muridae and Heteromyidae, but there was a strong positive correlation in the Family Cricetidae. The inconsistent results would preclude use of cyanide toxicity as an index to radiation sensitivity in rodents in general, but might apply in some larger families. Results of cyanide exposures and sulfur transferase activity suggested that resistance to ionizing radiation could not be totally related to the availability of free sulfhydryl groups. (auth)

Invertebrates

Refer also to abstract 9447.

9587 (EURISOTOP-ITE-78) IRRADIATION OF CARNATION MOTHS. Bestagno, G.; Piana, S.; Roberti, L.; Rota, P. (Commission of the European Communities, Brussels (Belgium). Bureau Eurisotop). [nd]. 28p. (In French). INIS.

13 refs.; 6 tabs.; 3 graphs; 2 plates. Translation from Notizario sulle Malattie delle Piante, No. 88(111 serie, No. 15).

Various varieties of carnations infested by larvae of Mediterranean and South African moths were gathered at random in the cultivation fields of the Riviera dei Fiori in Italy so as to form a heterogeneous population. They were exposed in ordinary baskets to different irradiation doses from a Co source. Observations made on the development cycle of the larvae contained in the irradiated baskets as a function of the irradiation dose were reported. The industrial application of the method can contribute to the resolution of the difficulties encountered in the production of Ligurian flowers for export. (tr-INIS)

9588 RADIATION-INDUCED INHIBITION OF RNA SYNTHESIS IN TETRAHYMENA PYRIFORMIS. Ernst, S. G.; Rustad, R. C.; Oleinick, N. L. (Case Western Reserve Univ., Cleveland). Int. J. Radiat. Biol.; 28: No. 1, 67-74(Jul 1975).

Radiation-induced disturbances in RNA synthesis were investigated in exponentially growing Tetrahymena. Sub-lethal doses of γ radiation lead to a transient, dose-dependent decrease in the rate of total RNA synthesis measured by ^{3}H-uridine incorporation, without an alteration of ^{3}H-uridine uptake by the cells. The rate of ^{3}H-uridine incorporation decreased exponentially with dose. In contrast, the duration of inhibition of RNA synthesis was linearly dependent on dose. Target-theory calculations suggest that the sensitive molecule has a molecular weight of about 2×10^7 Daltons. (auth)

9589 REPAIR OF LESIONS PROVOKED BY X RAYS IN EMBRYOS OF DROSOPHILA (D. MELANOGASTER MEIG). Ghelelovitch, S. (Inst. of Radium, Paris). Int. J. Radiat. Biol.; 27: No. 6, 513-523(Jun 1975). (In French)

The sensitivity of Drosophila eggs to the lethal action of x rays did not remain constant during embryogenesis. The x-ray doses used in the present investigation may have retarded the hatching of the larvae but did not block development immediately after irradiation. A fraction of the damage induced in young embryos was repaired during gastrulation. The amount of repair was independent of the x-ray dose but was influenced by the temperature. The damage could be repaired even after the cells of the embryo had undergone many mitotic cycles. (auth)

9590 POSSIBLE DEVELOPMENT OF RADIO-RESISTANCE IN SITOPHILUS ORYZAE (L.) FOLLOWING EXPOSURES OF SUCCESSIVE GENERATIONS TO IONIZING RADIATION. Matin, A. S. M. A. (Atomic Energy Centre, Dacca, Bangladesh). Int. J. Appl. Radiat. Isot.; 26: No. 10, 625-626(Oct 1975).

The effects of several generations of selection at substerilizing doses of gamma radiation on the radio-tolerance of Sitophilus oryzae are reported. Five radiation dose levels 0, 1, 2, 3, and 4 krad were tested with four replications per treatment. At the higher doses there were decreasing survivals in succeeding generations. Four krad population died out at generation 3, 3 krad at generation 4 and 2 krad population became extinct at generation 5. The relationship between radiation dose and mortality of the 6th generation adults of the selected and parent strains is shown graphically from which it is seen that there is no significant difference in the estimated LD_{50} for the two strains. From data presented on the fertility of the 6th generation adults it is seen that though the irradiated insects of the parent strain yielded more progeny than the irradiated insects of the selected strain these differences between the strains were not significant ($P > 0.05$). (UK)

9591 EFFECT OF NEAR ULTRAVIOLET AND VISIBLE LIGHT ON AMOEBA. Chatterjee, S.; Bhattacharjee, S. K. (Bhabha Atomic Research Centre, Bombay). J. Cell Sci.; 19: No. 1, 117-126(Oct 1975).

The near ultraviolet and visible light (VL) impinging at an intensity of 2.5×10^2 J s^{-1} m^{-2} for 2.5 h killed the mitotic and the early S-phase (0- to 15-min-old) amoebae. At the mid- and late S-period only a fraction of cells were killed by VL and the G_2 phase cells were quite resistant. Amoebae of all cell cycle stages showed a delay in the first mitotic division. DNA synthesis, as measured by [^{3}H] thymidine incorporation, was depressed in the VL-exposed early-S amoebae. A concurrent but temporary inhibition in [^{3}H] leucine incorporation also occurred in these cells. However, no significant change in [^{3}H] uridine

incorporation has been found. To localize the site of lethal damage, nuclear transplantation studies were undertaken between the control amoebae and the amoebae treated with VL. The nucleus of a VL-exposed early S-phase cell recovered when transplanted immediately after VL exposure into an enucleate G_2 cytoplasm but died if grafted into an enucleate S-phase cytoplasm. The therapeutic effect of the G_2 cytoplasm, although at a lower level, was also evident even when the treated early S-phase nucleus was implanted 20 h later, but not after 48 h, into the G_2 cytoplasm. The amoeba cytoplasm showed resistance to VL-irradiation, could accept a control nucleus from any cell cycle stage, and function normally. The G_2 nucleus also remained apparently unaffected to VL exposure and could survive when it was transferred to the control cytoplasm of any cell-cycle phase. All these findings are discussed in light of the possible existence of a repair system against VL-induced damage in the G_2-phase amoeba. (auth)

9592 EFFECT OF GAMMA IRRADIATION ON OOCYSTS OF EIMERIA NECATRIX. Singh, J.; Gill, B. S. (Punjab Agricultural Univ., Ludhiana, India). Parasitology.; 71: No. 1, 117-124(Aug 1975).

Effect of γ radiation on oocysts of Eimeria necatrix was investigated. It was observed that oocysts exposed to 200 kR or above did not sporulate. Irradiation at 10 to 150 kR caused a progressive decrease in sporulation. Irradiation affected normal development of unsporulated oocysts as the zygote protoplasm divided into unequal masses or was shattered into granules. Increase in the intensity of irradiation of sporulated oocysts resulted in the progressive decrease in severity of the resultant infections in chicks and their effects – mortality, type of lesions developed, total oocyst production, and immunity produced – were comparable with infections induced by decreasing the number of unirradiated oocysts. Infection produced by 1000 unirradiated oocysts was comparable with that resulting from 50,000 oocysts irradiated at 25 kR. Infection obtained with 20,000 unexposed oocysts approximated to that produced by 50,000 oocysts irradiated at 2.5 kR. It was concluded that irradiation abolished infectivity of the oocysts/sporozoites rather than bringing about attenuation of the parasite. (auth)

9593 NUCLEIC ACID METABOLISM IN SEA URCHIN EMBRYOS AND ITS ALTERATION AFTER X-IRRADIATION. Kimura, I. (Univ. of Tokyo). Exp. Cell Res.; 89: No. 2, 327-335(1974).

Nucleic acid metabolism observed during embryogenesis of the sea urchin (Hemicentrotus pulcherrimus) and its alteration after x irradiation were studied on both qualitative and quantitative bases. MAK chromatographic analysis has revealed that the stage-dependent synthesis of RNA occurred during embryogenesis: some RNA families were observed specifically for early cleavage stage, not being observed at stages later than gastrulation. Further, they were modified by irradiation pari passu with delay and inhibition of cleavage. These results were discussed in comparison with our previous results on normal and regenerating rat liver. (auth)

Radionuclide Effects (Internal Source)

9594 CUEX METHODOLOGY FOR ASSESSING RADIOLOGICAL IMPACTS IN THE CONTEXT OF ICRP RECOMMENDATIONS. Rohwer, P. S.; Kaye, S. V.; Struxness, E. G. (Oak Ridge National Lab., TN). pp 285-296 of Peaceful Nuclear Explosions. IV. Vienna; International Atomic Energy Agency (1975).

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975). See STI/PUB-414; CONF-750109-.

The Cumulative Exposure Index (CUEX) methodology was developed to estimate and assess, in the context of International Commission of Radiological Protection (ICRP) Recommendations, the total radiation dose to man due to environmental releases of radioactivity from nuclear applications. Each CUEX, a time-integrated radionuclide concentration (e.g. $\mu Ci \cdot h \cdot cm^{-3}$), reflects the selected annual dose limit for the reference organ and the estimated total dose to that organ via all exposure modes for a specific exposure situation (inhalation, ingestion, skin exposure or immersion in radioactive cloud). To assess the radiological significance of an environmental release of radioactivity, calculated or measured radionuclide concentrations in a suitable environmental sampling medium are compared with CUEXs determined for that medium under comparable conditions. The models and computer codes used in the CUEX methodology to predict environmental transport and to estimate radiation dose have been thoroughly tested. These models and codes are identified and described briefly. Calculation of a CUEX is shown step by step. An application of the methodology to a hypothetical atmospheric release involving four radionuclides (^{131}I, ^{85}Kr, ^{133}Xe, and tritium) illustrates use of the CUEX computer code to assess the radiological significance of a release, and to determine the relative importance (i.e. percentage of the estimated total dose contributed) of each radionuclide and each mode of exposure. The data requirements of the system are shown to be extensive, but not excessive in view of the assessments and analyses provided by the CUEX code. (auth)

Man

Refer also to abstracts 9279, 9510, 9615, and 9621.

9595 (BNWL-B-450) PUDEQ: A COMPUTER CODE FOR CALCULATING DOSE EQUIVALENT FROM INTERNAL DEPOSITION OF PLUTONIUM AT HANFORD. Houston, J. R.; Heid, K. R. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Oct 1975. Contract E(45-1)-1830. 42p. Dep. NTIS $5.45.

Presented here are the procedures and mathematical models used in developing PUDEQ, a computer program for computing the dose equivalent to body organs from intake of Pu. The program was designed specifically to use the data recorded on the Hanford Internal Exposure (HIE) System magnetic tape as input. Insofar as was possible, the recommendations of the Advisory Committee on Dose from Plutonium and other Transuranics was followed. Some deviations were made where errors, omissions, or inconsistencies were found, after consultation with members of the Committee. In the current version of the program only Pu and its immediate important daughters are considered. The program could, however, be expanded to include other transuranic nuclides. At present, only a few depositions of transuranic nuclides other than plutonium are recorded out of about 450 individuals involved in a total of over 700 plutonium intakes. (auth)

9596 (BNWL-SA-5463) RAPID REMOVAL OF SODIUM ISOTOPES FROM THE BODY FOLLOWING ACCIDENTAL INTERNAL CONTAMINATION. Palmer, H. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 9p. (CONF-751205-3). Dep. NTIS $4.50.

From IAEA international seminar on diagnosis and treatment of incorporated radionuclides; Vienna, Austria (8 Dec 1975).

The extensive use of liquid sodium as the primary coolant for fast breeder reactors presents human safety hazards from both the chemical toxicity of the sodium oxide and the radioactive toxicity of the large quantities of ^{24}Na and ^{22}Na in case of a rupture in the liquid sodium piping. Although the effects of the chemical toxicity are expected to be very immediate and more severe, the radioactive toxicity is also of significant concern. Other sources of radioactive sodium contamination exist in the nuclear industry. This paper describes some procedures which can significantly reduce the radiation dose to the body from ^{24}Na and ^{22}Na which might be accidentally inhaled or ingested. Studies with rats indicate that the retention time of the sodium isotopes which have exchanged with the body sodium pool can be reduced by a factor of 10 by ingestion of high levels of stable sodium. In addition, the ingestion of a sodium salt at the time or immediately after the inhalation incident could result in at least 60 percent or more of the inhaled radioactive sodium to be excreted before it exchanges with the body sodium pool. The combined effects of both immediate and sustained sodium ingestion in rats can result in a radiation dose from ^{22}Na of only 4 percent or less of that which would result if no additional salt is administered. The dose reduction for ^{24}Na would not be as much as that for ^{22}Na but would be significant. The tolerance for high levels of stable sodium intake in humans will be discussed and optimum intakes will be suggested which will provide the maximum radioactive sodium excretion with minimum harm to the physiological processes of the body. (auth)

9597 (CONF-760202-8) DETECTION OF INTERNALLY DEPOSITED ACTINIDES. Part III. Recent Background Studies at ORNL. Good, W. M.; Bemis, C. E.; Goans, R. E. (Oak Ridge National Lab., Tenn. (USA)). 1975. 6p. Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

It has been apparent from accumulated data at ORNL that the low-energy (less than 100 keV) phoswich background spectrum in the iron-shielded counting facility has components, possibly including a line below 15 keV, whose magnitudes show considerable variability. We have used a planar intrinsic Ge detector designed especially for measuring low-energy photons for background study as part of an evaluation of such a device for in vivo ^{239}Pu measurement. The spectrum that was observed consisted of a continuum upon which were superimposed discrete lines including a strong line at 10.35 keV in addition to the well-known lines from Pb X rays. Detectable also were X rays that corresponded to K-lines of several of the products of the naturally occurring radioactive decay series. Background spectra are presented and the implications of their variability are discussed. (auth)

9598 (CONF-760202-13) ESTIMATION OF DOSE COMMITMENT FROM AN ACCIDENTAL INTAKE OF ^{244}Cm. Bernard, S. R.; Poston, J. W. (Oak Ridge National Lab., Tenn. (USA)). 1975. 14p. Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

Four employees at the Oak Ridge National Laboratory experienced an intake by inhalation of ^{244}Cm as a result of an accidental release of this radionuclide. Urine and fecal samples were obtained and were analyzed in the Bioassay Laboratory at ORNL. Also, chest counts were made with the ORNL Whole-Body Counter. Ca-DTPA mists were inhaled within hours after the intake. These data together with data on the inhalation of ^{244}Cm in the dog were used to obtain a 50-year dose commitment to lungs, skeleton, and liver. The 50-year dose commitment to skeleton for two of the employees was estimated to be about 170 rem. The estimation methods used for dose commitment together with the values for other organs obtained are presented and discussed. (auth)

9599 (CONF-760202-19) EVALUATION OF TWO CASES OF ^{244}Cm INHALATION. Parkinson, W. W.; Henley, L. C.; Goans, R. E.; Good, W. M. (Oak Ridge National Lab., Tenn. (USA)). 1975. 7p. Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

Chest and systemic burdens were estimated for two employees who inhaled largely soluble compounds of ^{244}Cm. Chest burdens by whole-body counting were: Case A, 28 nCi; Case B, 34 nCi. The urinary excretion of the employees appeared to conform to a series of exponentials similar to those reported for blood and whole-body retention of Am in baboons. Accordingly, retention functions composed of a series of exponentials having 4, 12 to 17, and 72 day half-times were derived from urinary excretion and used to calculate body burdens, Case A, 7 nCi and Case B, 16 nCi. Cumulative fecal excretion by Case B was some 20 times that by Case A (63 nCi vs. 3.2) probably due to differences in deposition in the respiratory tract. Calculated organ doses for the first year were approximately 20 percent of recommended maxima. (auth)

9600 (CONF-760202-20) DETECTION OF INTERNALLY DEPOSITED ACTINIDES. Part IV. Preliminary Considerations in the Use of Large, Planar Intrinsic Ge Detectors. Bemis, C. E. Jr.; Goans, R. E.; Good, W. M.; Warner, G. G. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

Many inherent advantages are apparent in the use of large planar Ge detectors for the detection, identification, and quantitative assessment of internally deposited actinide nuclides (^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{241}Am, ^{244}Cm, ^{246}Cm, and ^{250}Cf). The superior energy resolution in contrast to Phoswich type scintillation detectors, permits isotopic identifications to be made and reduces ambiguities introduced by natural and human background effects. Preliminary studies indicate that a 10 cm^2 x 1.2 cm Ge detector is comparable in detection sensitivity to that of one 125 cm^2 Phoswich detector. Some preliminary considerations and evaluations, photon transport studies based on Monte Carlo modeling and measurements of absolute L-series X-ray yields in the decay of several actinide nuclides, are presented. (auth)

9601 HOT PARTICLE PROBLEM. Dolphin, G. W. (National Radiological Protection Board, Harwell, Eng.). Radiol. Prot. Bull.; No. 12, 18-19(Jul 1975).

The hot particle controversy is based on the possibility that high doses to small masses of cells in an organ could be more effective in producing cancer than low doses to the whole organ. The recommended dose limits in radiological protection are generally given in terms of the average dose to the organ. The recommended dose limit for α emitters of 1.5 rads in a year in the lung of mass 1000 g corresponds to 0.016 μCi plutonium-239, contained in 5×10^4 spheres each of one micron diameter of insoluble plutonium dioxide. Consideration of the density of lung tissue and penetration of the α particles showed that only 250 mg lung tissue would receive an average annual dose of 6000 rads provided that the spheres remained stationary in the lung tissue. The possible greater effectiveness of radiation from hot particles in producing cancer compared with equal amounts uniformly distributed is discussed in terms of three types of dose-response relationships. Both theoretical and experimental considerations led to the general conclusion that hot particles in the lung are not more effective in the production of cancer than uniform irradiation for the same average dose, and there is no evidence that the current radiological protection standards for plutonium are grossly in error. (UK)

9602 ACUTE CHANGES IN THYROID FUNCTION IN PATIENTS TREATED WITH RADIOACTIVE IODINE. Shafer, R. B.; Nuttall, F. Q. (Veterans Administration Hospital, Minneapolis). Lancet; 2: No. 7936, 635-636(4 Oct 1975).

Serum triiodothyronine (T_3) and thyroxine (T_4) were measured in thirteen unselected hyperthyroid patients before and at frequent intervals after iodine-131 treatment. There was an abrupt rise in T_3 from a pretreatment mean of 250 ng/100 ml to a maximum of 365 ng/100 ml at 24 hours. Total T_4 rose from a mean of 18.7 μg/100 ml to a maximum of 22.3 μg/100 ml at 24 to 48 hours. These findings may explain why an occasional patient develops acute thyroid crisis after radioiodine treatment. (auth)

9603 EFFECT OF SPECIFIC ACTIVITY ON THE TISSUE DISTRIBUTION AND ABSORBED RADIATION DOSE OF RADIOACTIVE COMPOUNDS. Kirschner, A. S. Ann Arbor, MI; Univ. of Michigan (1975). 123p. University Microfilms Order No. 75-20,380.

Thesis (Ph. D.).

The development of new radiopharmaceuticals is of paramount interest in the field of nuclear pharmacy. A radiopharmaceutical should preferentially localize in the organ of interest, the target organ. The distribution of the compound should exclude localization in any organ other than the target organ so as to maximize target-to-nontarget (T/NT) ratios. Maximum T/NT ratios are necessary in order that the observed contrast between the target and nontarget organs would be high enough to allow clinically useful diagnostic information to be obtained. The present study was undertaken to show that by varying the specific activity of a radioactive compound, while injecting the same total amount of radioactivity, the distribution of the radioactivity in the tissues would be altered. The compounds chosen were ^{3}H-dihydrotestosterone and ^{75}Se-selenomethionine. Also, estradiol, labeled with I-123, was theoretically studied. The T/NT ratios were shown to decrease with increasing administered mass dose of each compound. ^{75}Se-selenomethionine pancreas-to-liver ratios decreased due to an increase in liver radioactivity concentration. The prostate-to-liver ratios associated with the administration of ^{3}H-dihydrotestosterone, and the theoretical uterus-to-liver ratios associated with ^{123}I-estradiol, decreased due to a linear increase in nontarget organ concentration with a nonlinear increase in target organ concentration of radioactivity. The target organ concentrations determined with ^{3}H-dihydrotestosterone and ^{123}I-estradiol were shown to plateau at high administered mass doses due to saturation of available binding sites. Spillover of radioactivity to nontarget organs was shown to occur with the radioactive compounds chosen for this study. This effectively increases the concentration of radioactivity in nontarget organs, thereby increasing the absorbed radiation dose to those organs, while reducing the T/NT ratios. The overall effect of administering large mass doses of radioactive compounds chosen for use in this study is to reduce requisite target-to-nontarget ratios and, hence, reduce the diagnostic information obtainable and to increase the patient's absorbed dose to nontarget organs. (Disser. Abstr.)

9604 SKELETAL AND TISSUE LESIONS RESULTING FROM EXPOSURE TO RADIUM AND FISSION PRODUCTS. Warren, S. (Cancer Research Inst., Boston). Ann. Clin. Lab. Sci.; 5: No. 2, 75-81(1975).

The chief effects of absorbed radionuclides and external radiation are radiation osteitis, disturbed bone growth, myelofibrosis, and bone tumors. The lesions are dependent in part on localization and character of the radiation and in part on dose. Data on radium have been derived from dial painters, radium chemists, and those treated some years ago by oral or parenteral administration. (auth)

9605 BIOLOGICAL TESTS FOR THE FOLLOW-UP OF PATIENTS TREATED WITH RADIOIODINE FOR HYPERTHYROIDISM. Tubiana, M.; Freychet, P.; Segond, G.; Timet, S. M. (Institut Gustave-Roussy, Villejuif, France). Ann. Endocrinol. (Paris); 35: No. 1, 40-44(1974). (In French).

Various biological tests may be used during the follow-up of a patient treated with radioiodine for hyperthyroidism. There is often during this course of the disease a discrepancy between the radioiodine uptake and the clinical status of the patient. This is partly due to a decrease of the extrathyroid iodide pool and to an hormonogenesis defect. The plasma TSH level appears to be the most sensitive and most reliable test for the early detection of an evolution toward hypothyroidism. However, a subject may remain during a few years with a high TSH plasma level and euthyroid from a clinical and biological point of view. This phase of the course of the disease appears to be transitory and subsequently the patient becomes hypothyroid. (auth)

9606 LONG-TERM FOLLOW-UP RESULTS IN CHILDREN AND ADOLESCENTS TREATED WITH RADIOACTIVE IODINE (^{131}I) FOR HYPERTHYROIDISM. Safa, A. M.; Schumacher, O. P.; Rodriguez-Antunez, A. (Cleveland Clinic Foundation). New Engl. J. Med.; 292: No. 4, 167-170(23 Jan 1975).

To evaluate the long-term results of ^{131}I therapy for children,

the course of 87 patients (three to 18 years old, 24 boys and 63 girls) treated from 1949 through 1968, for hyperthyroidism due to Graves's disease was studied. Dose of ^{131}I per patient ranged from 2.9 to 31 mCi (mean +- S. D., 9.75 +- 6.5). Patients were followed for five to 24 years (mean, 12.3 +- 3.5). Hyperthyroidism was controlled in 85 within one to 14 months (mean, 3.3 +- 2.6). Recurrence of thyrotoxicosis due to toxic diffuse goiter, observed in only one case after 11 years, was successfully re-treated with ^{131}I. Reproductive history and health status of the progeny of ^{131}I-treated patients were not different from those of the general population. No deaths and no cancer or leukemia were observed in patients or their offspring. The major cause of goiter regrowth was Hashimoto's thyroiditis. Hypothyroidism developed in 35 of 76 patients (46 percent). ^{131}I deserves further use in treatment of hyperthyroid children with Graves's disease. (auth)

9607 PLUTONIUM: ASSESSMENT OF THE OCCUPATIONAL ENVIRONMENT. Schulte, H. P. (Los Alamos Scientific Lab., NM). Health Phys.; 29: No. 4, 613-618(Oct 1975).

From proceedings of the second Los Alamos life sciences symposium; Los Alamos, NM, USA (22 May 1974).

Attempts to assess the relative hazards (or lack of hazards) associated with plutonium dissemination to the environment emphasize the need for quantitative data to resolve the many unanswered questions regarding environmental plutonium behavior. This review summarizes most of the available data on plutonium in native terrestrial plants and animals and discusses some of the known and speculative mechanisms by which plutonium moves into biota. Factors which require consideration in preparing environmental plutonium safety evaluations are discussed. (auth)

9608 PLUGGED HAVERSIAN CANALS AND SKELETON DOSE IN RADIUM CASES. Simmons, D. J.; Keane, A. T.; Holtzman, R. B.; Marshall, J. H. (Argonne National Lab., IL). Health Phys.; 29: No. 5, 767-775(Nov 1975).

The fraction of haversian canals plugged or partially plugged by hypercalcified matrix in skeletons from 30 cases of radium poisoning was found to correlate well with dose, especially as expressed in cumulative rad-yr. There was no significant correlation with age at exposure, age at death, or duration of radium intake either directly or in multiple regression analysis. For 14 of the cases exposed predominantly to ^{226}Ra, cumulative rads (CR) and cumulative rad-yr (CRY) correlated about equally well, but when all 30 cases were considered, including 14 cases exposed predominantly to ^{228}Ra, the correlation coefficient between plugging and CRY was 0.81 (P much less than 0.01), while that with CR was only 0.48 (P less than 0.01). Plugging varied approximately as the square root of either CR or CRY within the range of doses observed (1 to 30 krads and 10 to 700 krad-yr). The expression, (percent plugs)/sup 1.8/, predicts the observed CRY in krad-yr within a factor of two in two-thirds of the cases. Plugging due to radium can probably not be detected below a CR of 1000 rads or a CRY of 10 krad-yr because the normal incidence is the order of 1 percent. Reduced x-ray score for the same 30 cases also correlated with CRY, but not as well as did the plugged canals. (auth)

9609 THOROTRAST-INDUCED EXTRASKELETAL OSTEOSARCOMA OF THE CERVICAL REGION: REPORT OF A CASE. Hasson, J.; Hartman, K. S.; Millkow, E.; Mittelman, J. A. (Mount Sinai Hospital, Hartford). Cancer; 36: No. 5, 1827-1833(Nov 1975).

This is the seventh reported case of a soft tissue sarcoma attributed to Thorotrast extravasated during the course of an injection for arteriography. An extraskeletal osteosarcoma occurring in the cervical region of a 51-year-old man 30 years after a cerebral arteriogram is presented. The other reported cases include a fibrosarcoma, two neurofibrosarcomas, two spindle cell sarcomas, and an extraskeletal chondrosarcoma. The latency period has varied from 5 to 30 years. The Thorotrast granules are readily identified in macrophages near or adjacent to the tumor, and the demonstration of alpha tracks on autoradiographs is diagnostic. (auth)

Animals

Refer also to abstract 9626.

9610 VIRUSES IN OSTEOSARCOMAS INDUCED BY ^{226}Ra. A Study of the Induction of Bone Tumors in Mice. Lloyd, E. L.; Loutit, J. F.; Mackevicius, F. (Argonne National Lab., IL). Int. J. Radiat. Biol.; 28: No. 1, 13-33(Jul 1975).

Three groups (15 in each) of 3-month-old mice were injected intraperitoneally with 0.5 uCi ^{226}Ra. They were male and female C3H/H and female CBA/H. The groups were matched by similar controls that were not injected. Osteosarcomas were found in 14/15 of the female C3H/H mice-animals known to carry mammary-tumor viruses in milk – compared with 6/15 in their male counterparts. In CBA/H female mice, which have a very low incidence of both mammary tumors and leukemia, osteosarcomas developed in 7/15 of the animals. The CBA/H mice lived about 5 to 8 months longer and revealed their osteosarcomas at a correspondingly later time than C3H/H mice. Virus particles were observed in each of the three mammary tumors and in 15 out of the 17 osteosarcomas examined by electron microscopy. No definitive statement can be made from this experiment whether or not osteosarcoma was caused by a virus; but the results suggest that viruses may be a contributory factor in the development of the osteosarcoma in these animals. (auth)

9611 INFLUENCE OF A CARBACHOL AEROSOL ON THE TRACHEOBRONCHIAL DEPOSITION OF ^{99m}Tc TAGGED PARTICLES. Tomenius, L. (Kungliga Karolinska Mediko-Kirurgiska Inst., Stockholm); Strandberg, K.; Camner, P. Environ. Physiol. Biochem.; 5: 78-83(1975).

The tracheobronchial deposition of inhaled ^{99m}Tc tagged teflon particles of 6 μm (specific density 2 g/cm^3) was determined in rabbits by comparing the particle content in free dissected parts of the tracheobronchial tree with that in the whole lung. There was a significantly larger deposition of particles in the proximal parts of the airways in rabbits exposed to an aerosol of the bronchoconstrictor compound carbachol than in control rabbits exposed to distilled water alone. The resistance to insufflation of a constant volume of air increased during the exposure to the carbachol aerosol, indicating bronchoconstriction. There were reproducible interindividual differences in bronchoconstrictor response to the carbachol aerosol. They were attributed to interindividual differences either in deposition of carbachol or in bronchial muscle sensitivity to carbachol. It is concluded that bronchoconstriction might serve as a defensive measure in causing a more proximal deposition of inhaled particles. (auth)

9612 MECHANISM OF ACUTE RENAL FAILURE AFTER URANYL NITRATE. Blantz, R. C.; Konnen, K. (Univ. of California, San Diego). J. Clin. Invest.; 55: No. 3, 621-635(Mar 1975).

Administration of 25 mg/kg uranyl nitrate (UN) to rats leads to a brief period of polyuria followed by progressive oliguria with death at 5 days. Factors that determine glomerular filtration rate (GFR) were examined in control Munich–Wistar rats (n equals 16) and 2 h after either 15 mg/kg (n equals 8) or 25 kg/kg (n equals 7) of UN (i.v.) utilizing direct measurements of hydrostatic and oncotic pressures and plasma flow. Total kidney GFR was reduced to 47 percent of control in the low dose group and to 21 percent in the high dose group. The simultaneous nephron filtration rate (sngfr) was 28.6 +- 0.8 nl/min/g kidney wt in control, 29.1 +- 1.0 in the low dose group, and 18.1 +- 1.2 (P less than 0.001) in the higher dose group. This disparity in UN effect upon GFR and sngfr was due to tubular back-diffusion of solute through damaged epithelia beyond the early proximal tubule as demonstrated by microinjection of inulin and mannitol in the proximal tubule. Inulin "leak" persisted at 6 h after UN when tubular pressure had returned to normal. Comparison of sngfr measured in early vs late proximal tubule revealed no difference after high dose UN, suggesting no significant leak of inulin from the early proximal tubule, and that the decreased sngfr was due to primary reductions in ultrafiltration. Nephron plasma flow was equal to control at both doses of UN. Also directly measured hydrostatic pressure gradient across the glomerular capillary was not changed. The effective filtration pressure achieved equilibrium in control animals but became significantly positive at the efferent end of the capillary at both doses of UN and increased. Total glomerular permeability (L/sub p/A) was progressively reduced from control (0.089 +- 0.005 nl/s/g kidney wt/mm Hg) at low dose UN (0.047 +- 0.013) and high dose (0.024 +- 0.003 nl/s/g kidney wt/mm Hg). Therefore UN decreases GFR by two mechanisms: (a) tubular damage leading to back-diffusion of solutes and (b) a primary reduction in sngfr due to reduced L/sub p/A. (auth)

Plants

9613 EFFECT OF GROWTH IN D_2O ON THE METABOLISM OF WINTER RYE. Waber, J. (Hawaii Univ., Honolulu). J. Exp. Bot.; 26: No. 93, 609-617(Aug 1975).

The metabolism of winter rye seedlings (Secale cereale, L. cv. Winter) cultured in 99.8 percent D_2O was investigated. Compared with water-grown seedlings, the protein content was much lower in the D_2O-cultured seedlings and the pattern of incorporation of [^3H] leucine and [^3H] phenylalanine into protein was substantially different. Seedlings cultured in D_2O incorporated [^3H] thymidine into DNA, but did not take up [^3H] uridine. The results suggest that some of the toxic effects of D_2O culture on higher plants can be attributed to a partial block of protein synthesis. (auth)

Nuclide Kinetics and Toxicology

Man

Refer also to abstracts 9290 and 9699.

9614 DETERMINATION OF INDIVIDUAL ^{131}I-HIPPURATE-CLEARANCE IN PTOTIC KIDNEYS COMBINED WITH SEQUENTIAL SCINTIGRAPHY (GAMMA-CAMERA). Leisner, B.; Buell, U.; Rohloff, R.; Hast, B.; Heinze, H. G. (Muenchen Univ. (F. R. Germany). Klinik und Poliklinik fuer Radiologie). Nucl.-Med.; 14: No. 2, 125-132(Jun 1975). (In German).

1 fig.; 2 tabs.; 23 refs.

In 65 patients with uni-or bilateral nephroptosis the ^{131}I-hippurate-clearance of each kidney was determined in combination with sequential gamma camera scintigraphy. The clearance values were normal in 65% without changing due to patient position. In 35% of the ptotic kidneys clearance values were lower than normal as well as in 17.5% of the nonptotic contralateral kidneys. 23% of the ptotic kidneys showed diminished clearance values in the upright position, whereas a significant increase was found in prone position. Such short-time changes of the ^{131}I-hippurate-clearance indicate diminished perfusion of the kidney when it is moving downward. (auth)

9615 DEMONSTRATION OF RADIOGOLD AND MERCURY IN THE SYNOVIAL TISSUE FOLLOWING INTRAARTICULAR ADMINISTRATION OF RADIOGOLD. Mohr, W.; Hersener, J.; Richter, R.; Beneke, G.; Sievers, B. U. (Ulm Univ. (F. R. Germany). Abt. Pathologie 2; Allgemeine Elektricitaets-Gesellschaft AEG Telefunken, Ulm (F. R. Germany). Forschungsinstitut; Friedrich von Hessingsche Orthopaedische Heilanstalt, Goeggingen/Augsburg (F. R. Germany). 1. Orthopaedische Klinik). Z. Rheumatol.; 33: No. 7/8, 284-290(Jul 1974). (In German).

3 figs.; with refs.

Synovial tissue and synovial fluid cells were investigated after intraarticular administration of radioactive gold (^{198}Au). By autoradiographic investigations ^{198}Au was detected in synovial fluid cells, synovial lining cells, and macrophages in the synovial membrane. Examinations by means of energy-dispersive x-ray microanalysis demonstrated gold and mercury depositions in the synovial membrane. The existence of mercury 8 weeks after administration of radiogold may be responsible for the long-standing therapeutic effect of radiogold therapy. (auth)

9616 CALIBRATION AND MEASUREMENT OF ^{40}K WITH WHOLE-BODY COUNTER. Van Reenen, O. R.; Lotter, M. G.; Minnaar, P. C.; Iturralde, M. (Univ. of the Orange Free State, Bloemfontein, S. Afr.). S. Afr. Med. J.; 48: No. 59, 2482(7 Dec 1974).

Total potassium content in the human body may be obtained by measuring naturally occurring radioactive ^{40}K in a whole-body counter. The basic problem in calibrating the whole-body counter is discussed, as well as a phantom that is used to solve this problem. The normal potassium levels for men and for women were determined. Two additional parameters–lean body mass and total body water–derived from the potassium content, were also calculated. (auth)

9617 DYNAMIC SHAPE FACTORS FOR PuO_2 AEROSOLS USEFUL IN AUTORADIOGRAPHIC PARTICLE SIZE ANALYSIS. Kotrappa, P.; Sundararajan, A. R.; Bhanti, D. P.; Menon, V. B. (Bhabha Atomic Research Centre, Bombay). Health Phys.; 29: No. 5, 701-704(Nov 1975).

The relationship between the dynamic shape factor (K) of an irregularly shaped particle and its aero-dynamic diameter (D_{ae}) is given in terms of the density of the particle, (D_{ev}) the diameter of the equivalent volume and the slip factor corresponding to the diameter D. PuO_2 aerosols sampled from a glove box were separated into several narrow aerodynamic size groups using an aerosol spectrometer (Lovelace Aerosol Particle Separator) in the size range 0.7 to 4.0 μm. For each size group, the diameter of the equivalent volume was determined by standard autoradiographic techniques. Using D_{ev} and the corresponding D_{ae}, dynamic shape factors were calculated. This factor was found to be relatively constant with a mean value of 1.8. Using this factor, any autoradiographic data on D_{ev} can be converted into the corresponding D_{ae} using the equation given. The procedure of computing D_{ae} from D_{ev} is an essential step in evaluating inhalation hazards due to plutonium aerosols. (auth)

9618 DETERMINATION OF ^{210}Po IN URINE. Bale, W. F.; Helmkamp, R. W.; Hrynyzyn, V.; Contreras, M. A. (Univ. of Rochester, NY). Health Phys.; 29: No. 5, 663-671(Nov 1975).

To measure ^{210}Po present in normal human urine a technique was developed in which a 4.5 x 11 cm silver foil was shaken at room temperature for 48-hr periods in each of two successive volumes of 1.7 l. of urine acidified to 0.5 N with HCl. Alpha rays were counted with an ionization chamber, coupled to a vibrating reed electrometer, and capable of measuring alpha-ray pulses originating on both sides of the silver foil serving as a central electrode. The background alpha-count was less than 2/hr. Analyses of human urine spiked with 0.29 to 0.58 pCi of ^{210}Po, together with studies of urine from dogs carrying significant body burdens of ^{210}Pb, indicated that the average recovery of added ^{210}Po from 1.7 l. volumes of spiked human urine was 72 percent. If it is assumed that the same percentage of ^{210}Po is extracted from non-spiked urine, then the average ^{210}Po concentration found in 13 analyses of 2 x 1.7 l. samples from 26 different pools of fresh human urine was 0.023 pCi/l. Substantial additional ^{210}Po was generated on short aging of the urine through radioactive decay of excreted ^{210}Bi. (auth)

9619 DEPOSITION MODEL OF THE TASK GROUP ON LUNG DYNAMICS: A COMPARISON WITH RECENT EXPERIMENTAL DATA. Mercer, T. T. (Univ. of Rochester, NY). Health Phys.; 29: No. 5, 673-680(Nov 1975).

A comparison with recent experimental data reveals that the Task Group deposition model adequately describes total deposition during nasal breathing. Measurements made on subjects during normal breathing support the use of Pattle's (Inhaled Particles and Vapours. p203. Pergamon Press. (1969)) empirical equation to define deposition in the nasopharyngeal compartment, but some of the new data indicate that pressure drop across the nose may be a significant parameter in nasal deposition. Although a very limited amount of data on a single subject reported earlier suggests that the Task Group's model may underestimate pulmonary deposition during nasal breathing, extensive results on regional deposition during mouth breathing make it appear that the model generally overestimates pulmonary deposition at the expense of tracheo-bronchial deposition. (auth)

9620 ANIMAL DATA ON PLUTONIUM TOXICITY. Thompson, R. C. (Battelle Pacific Northwest Labs., Richland, WA). Health Phys.; 29: No. 4, 511-519(Oct 1975).

From proceedings of the second Los Alamos life sciences symposium; Los Alamos, NM, USA (22 May 1974).

Animal data are necessary in the assessment of plutonium toxicity since it is unlikely that the necessary information on effects from humans will be obtained. Experiments on animals must be designed to provide understanding of the mechanisms at work if the results are to be applied to man since it is a statistical impossibility to design experiments to measure directly the low levels of risk that are of concern. Cancer induction appears to be the risk of greatest concern with the lung and bone apparently the most susceptible organs, depending upon the method of administration. Current limitations on these organs do not appear to have the safety margin formerly believed and there are some uncertainties in the extrapolation from animal data to man. (auth)

9621 CONCEPTS OF CRITICAL ORGAN AND RADIATION DOSE AS APPLIED TO PLUTONIUM. Stannard, J. N. (Univ. of Rochester, NY). Health Phys.; 29: No. 4, 539-550(Oct 1975).

From proceedings of the second Los Alamos life sciences symposium; Los Alamos, NM, USA (22 May 1974).

The concepts of critical organ or tissue and the calculation of radiation dose have been and may well continue to be central to the development of standards for most radionuclides. In the case of plutonium the occupational standard was based on a modification of the direct calculations of maximum permissible annual dose (MPAD) or dose rate but critical organs must still be chosen for different routes of entry and different compounds and for all of the derived standards. Changes in such standards by likely variations in metabolic parameters and models are shown to be significant but not large. Application of the critical organ concept to population exposure standards poses some new problems because the basic MPAD does not distinguish among organs. By-passing some of the problems in present practices by using risk-estimates seems unlikely for plutonium at the present time because of the paucity of human effects data and the fact that the animal experiments used quite different dose regimens from the likely exposure situations to plutonium. A brief comparison is made of radiation and chemical hazard evaluation procedures. (auth)

9622 WHAT WE HAVE LEARNED ABOUT PLUTONIUM FROM HUMAN DATA. Voelz, G. L. (Los Alamos Scientific Lab., NM). Health Phys.; 29: No. 4, 551-561(Oct 1975).

From proceedings of the second Los Alamos life sciences symposium; Los Alamos, NM, USA (22 May 1974).

Human data on plutonium deposition, internal distribution, and excretion have been obtained by observations after accidental occupational exposures, long-term follow-up studies on plutonium workers, and autopsy tissue analyses. No significant harmful

effects have been noted in humans, although a small foreign-body type nodule around dermal implantations of plutonium has been described in eight persons. Methods used to estimate body burdens by urinary excretion values appear to be conservative generally compared to autopsy tissue burdens. Variations in autopsy tissue distribution appear to be related to the conditions of the plutonium exposure including mode of exposure, particle size, chemical composition, solubility in serum or tissue fluids, and time after exposure for internal redistribution. An important conclusion of this human data survey is the recognition of the inestimable value to be gained by continued careful studies on the life history of workers with higher plutonium exposures. (auth)

Animals

Refer also to abstracts 8996, 9283, 9291, 9544, and 9681.

9623 (BNWL-SA-5430) EFFECT OF PHYSICO-CHEMICAL PROPERTIES ON METABOLISM OF TRANSURANIUM OXIDE AEROSOLS INHALED BY BEAGLE DOGS. Craig, D. K.; Park, J. F.; Ryan, J. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 28p. (CONF-751073-1). Dep. NTIS $5.00

From meeting of the Association for Aerosol Research; Bad Soden, F.R. Germany (16 Oct 1975).

The oxides of four transuranium isotopes (^{238}Pu, ^{239}Pu, ^{241}Am, and ^{244}Cm), prepared by identical methods of calcining the oxalate at 750^{0}C for two hours, had different physico-chemical properties. For all four oxides the density ranges from 9.8 to 11.4 g cm^{-3} and initial ultrafilterability (suspended fraction of activity less than 24 A) varied from 0.002 percent for $^{239}PuO_2$ to 2.24 percent for $^{238}PuO_2$. Dogs were exposed by nose-only techniques to aerosols generated by nebulizing water suspensions of the oxides. The dogs were sacrificed at intervals from one week to about a year postexposure. The rate of translocation of material from lung to other tissues increased from ^{239}Pu to ^{238}Pu to ^{241}Am to ^{244}Cm, possibly reflecting the decrease in mean particle size from an MMD of 0.7 mu m to $^{239}PuO_2$ to 0.6 mu m for $^{238}PuO_2$ to 0.4 mu m for $^{241}AmO_2$ to 0.1 mu m for ^{244}CmO/sub x/. Accumulation of the isotopes in the liver and skeleton as a percentage of final body burden was 1 percent ^{239}Pu and 7 to 23 percent for ^{238}Pu at about a year postexposure, while at 270 days postexposure, values were 40 percent for ^{241}Am and 40 to 30 percent for ^{244}Cm. (auth)

9624 (HW-21868) PLUTONIUM METABOLISM: A LITERATURE REVIEW. Katz, J. (Hanford Works, Richland, Wash. (USA)). 2 Jan 1951. Contract W-31-109-eng-52. 24p. Dep. NTIS $4.50.

A review is presented of the literature on the metabolic behavior of ^{238}Pu and ^{239}Pu in laboratory animals. Information is included on major portals of entry into the body, distribution in tissues, excretion, effects of valence, toxicological studies, and displacement from organs. A list of 58 references is included. (auth)

9625 DETERMINING LIVER RETENTION OF TRANSURANIUM ELEMENTS IN LIVING BEAGLES. Lloyd, R. D.; Mays, C. W. (Utah Univ., Salt Lake City (USA). Radiobiology Div.). Radiat. Environ. Biophys.; 12: No. 2, 139-145(Jul 1975).

2 figs.; 2 tabs.; 3 refs.

A method has been developed whereby the liver content of photon-emitting transuranium elements can be determined in living beagles by a combination of total-body and partial-body counting. Calibration of the system was accomplished through the photon counting of intact dogs and also of the parts of the same animals following autopsy. A determination of the calibration factors for ^{252}Cf, ^{247}Cf, ^{243}Cm, ^{237}Pu, and ^{241}Am has been made. The special case of ^{252}Cf was treated in which a significant fraction of the high energy fission gamma-ray spectrum penetrates the Pb shield employed in partial-body counting, and methods were developed which allow for this effect in the calculation of liver content. Some uniformity of response in the system was evident for all of the emitters which were considered. It is proposed that similar techniques could be applied in the determination of selected organ radioactivity in other species including man. (auth)

9626 RADIATION DOSE FROM PLUTONIUM DEPOSITED IN MARROW AND BONE OF NORMAL AND CHIMAERIC MICE. Humphreys, E. R.; Green, D. (Medical Research Council, Harwell, Eng.). Int. J. Radiat. Biol.; 27: No. 6, 561-567(Jun 1975).

Plutonium-239 citrate was injected intraperitoneally into CBA mice and into CBA mice which had been made chimaeric by replacing their haematopoietic bone-marrow with that from another genetically-identical but cytologically-distinct strain. The mice were killed at three intervals up to 90 days after injection, and the deposited ^{239}Pu was determined radio-chemically in bone-marrow and in bone. The average radiation dose (integrated over 90 days) was found to be greater in the bones but lower in the marrow of chimaeric mice than in the corresponding tissues of the normal CBA mice. These results are discussed from the points of view of induction of malignant change in marrow and bone and of plutonium metabolism in the two types of mice. (auth)

9627 STUDIES ON THE INCORPORATION OF ^{14}C IN TISSUES OF GALLERIA MELLONELLA. Mallik, M. U. (Atomic Energy Centre, Dacca, Bangladesh). Int. J. Appl. Radiat. Isot.; 26: No. 9, 567-569(Sep 1975).

Studies of the introduction of ^{14}C through different carriers separately in Galleria mellonella in one stage of its development and the observation and comparison of the pattern of distribution of ^{14}C in the key tissues of the insect are reported. Three different radioactive substances uniformly labelled with ^{14}C viz, glucose-^{14}C, glycine-^{14}C, and glycerol-^{14}C were used in the study. Results show high content of glycerol in fatbody which indicates that storage of it is maintained in fatbodies of insects. Differences between the radioactivity in unlaid eggs and laid eggs in the groups of glucose-^{14}C and glycine-^{14}C indicate that a considerable amount of radioactivity was incorporated during the period between ovulation and oviposition. The incorporation of glycerol-^{14}C in unlaid eggs was higher than that of glucose-^{14}C or glycine-^{14}C. Autoradiographic study shows that glucose-^{14}C was distributed homogenously both in the mainbody of egg and in the chorion region. However, concentration of the isotope was higher in the latter. (UK)

9628 RELATIONSHIP OF CHEMICAL STRUCTURE AND SOLVENT TO IN VIVO SCINTIGRAPHIC DISTRIBUTION PATTERNS OF ^{11}C COMPOUNDS. II. ^{11}C Aminonitriles. Winstead, M. B.; Widner, P. J.; Means, J. L.; Engstrom, M. A.; Graham, G. E.; Khentigan, A.; Lin, T. H.; Lamb, J. F.; Winchell, H. S. (Bucknell Univ., Lewisburg, PA). J. Nucl. Med.; 16: No. 11, 1049-1057(Nov 1975).

The preparation and scintigraphic evaluation of the distribution patterns in dogs of a series of structurally related aminonitriles labeled with ^{11}C is described. (CH)

9629 UPTAKE, DISTRIBUTION, AND INCORPORATION OF ^{59}Fe IN TISSUE AND BLOOD OF RAINBOW TROUT (SALMO GAIRDNERI). Walker, R. L. East Lansing, MI; Michigan State Univ. (1975). 127p. University Microfilms Order No. 75-20,000. Thesis (Ph. D.).

A study was designed to evaluate the storage iron facilities in various tissues and to trace the distribution of radioiron in tissues and blood following an intraperitoneal (i.p.) injection of ^{59}Fe. Iron deficiency anemia was induced in an experimental group of rainbow trout in order to measure its effect on red blood cell production and mobilization of storage iron. Most of the ^{59}Fe was absorbed from the peritoneal cavity within 24 hrs. after the i.p. injection. Equilibrium between the plasma ^{59}Fe pool and that of the tissue was established by day 8. Experimental fish RBC ^{59}Fe content increased to 70 to 80 percent of the initial injected dose by day 16 compared to 50 percent in the controls. This was attributed to the difference in reticulocyte count which was 10 to 12 percent for the bled and 2 to 3 percent for control fish. The rate that iron is incorporated into hemoglobin by immature red cells is much slower (about half) than the rate of RBC ^{59}Fe uptake, thus, iron is temporarily stored in the cytoplasm. The iron for hemoglobin formation was obtained from liver iron stores which dropped from 12 percent to less than 1 percent of the initial injected dose by day 16. Total iron concentration in liver decreased from 200 to less than 100 mu g Fe/g. The decrease in liver iron may have stimulated iron absorption by the intestine and pyloric caeca. There is evidence for a feedback mechanism mediated by transferrin. (Diss. Abstr. Int., B)

9630 Ca-DTPA TOXICITY IN THE MOUSE FETUS. Fisher, D. R.; Mays, C. W.; Taylor, G. N. (Univ. of Utah, Salt Lake City). Health Phys.; 29: No. 5, 780-782(Nov 1975).

It has been shown in previous work that Ca-DTPA is only slightly more effective than Zn-DTPA in the removal of actinide metals from experimental animals but that treatment with the calcium chelate can have toxic side effects. An investigation of the effect of Ca-DTPA and Zn-DTPA injections of female mice on their developing fetuses is reported. Injection schedule and birth data are tabulated. There were no viable offspring produced by dams injected daily with 2.9 mmole Ca-DTPA/kg; with an injection dosage of 0.36 mmole Ca-DTPA/kg fecundities were near normal, as were fetal development and growth rates during the lactation period. On the other hand by using the same levels of dosage with zinc trisodium chelate no apparent harm was suffered by either

mothers or pups. It is concluded that while both the calcium and zinc salts of DTPA are highly effective chelating agents, the demonstrated fetal toxicity of the calcium chelate indicates that Ca-DTPA should not be given to a woman who might be pregnant. If chelation therapy is warranted, the much safer Zn-DTPA, rather than Ca-DTPA, should be used. (UK)

9631 PLUTONIUM IN MAMMALS: INFLUENCE OF PLUTONIUM CHEMISTRY, ROUTE OF ADMINISTRATION, AND PHYSIOLOGICAL STATUS OF THE ANIMAL ON INITIAL DISTRIBUTION, AND LONG-TERM METABOLISM. Durbin, P. W. (Univ. of California, Berkeley). Health Phys.; 29: No. 4, 495-510(Oct 1975).

From proceedings of the second Los Alamos life sciences symposium; Los Alamos, NM, USA (22 May 1974).

Current concepts of Pu metabolism are reviewed. Metabolic models of the Pu intake by human populations of mixed age are based on certain over-simplified assumptions which are here considered and the factors that influence the absorption and distribution of Pu in animals and the long-term fate of Pu are discussed. The factors examined include; chemical properties of biological importance, gastrointestinal absorption, absorption from parenteral sites, absorption from the lung, body and tissue distribution of soluble plutonium, plutonium deposition and skeletal maturity, tissue distribution of particulate plutonium, long-term fate of particulate plutonium and of initially soluble plutonium. (UK)

9632 DTPA THERAPY OF ^{241}Am FROM A SIMULATED WOUND SITE. Lloyd, R. D.; Taylor, G. N; Mays, C. W.; McFarland, S. S.; Atherton, D. R. (Univ. of Utah, Salt Lake City). Health Phys.; 29: No. 5, 808-811(Nov 1975).

The results of an investigation to determine the effect of daily injections over a period of 10 weeks of Zn-DTPA on the distribution of ^{241}Am from a simulated wound site on the carpal pad of beagles are reported. It is shown that daily injections of Zn-DTPA hastened the disappearance of ^{241}Am from the simulated wound site, prevented almost completely the translocation from the depot to the liver and skeleton, and reduced significantly the total body ^{241}Am content through increased excretion. Dividing the daily total administration of Zn-DTPA into five equal fractions given at about 5-hr intervals seemed to increase somewhat the effectiveness of this chelating agent relative to the administration of the same daily total given in a single injection each day. (UK)

9633 REMOVAL OF INHALED $^{239}PuO_2$ FROM BEAGLE DOGS BY PULMONARY LAVAGE. McDonald, K. E.; Park, J. F.; Dagle, G. E.; Sanders, C. L.; Olson, R. J. (Battelle Pacific Northwest Labs., Richland, WA). Health Phys.; 29: No. 5, 804-805(Nov 1975).

Of beagle dogs which had been exposed to a submicron aerosol of $^{239}PuO_2$ some were treated by sessions of pulmonary lavage and some by a course of DTPA injections. It was shown that DTPA treatment had no significant effect on the retention, excretion, or translocation of inhaled $^{239}PuO_2$. Periodic right lung lavage removed a total of about 50 percent of the ^{239}Pu present in the right lung, or about 27 percent of the total lung ^{239}Pu burden. The effectiveness of pulmonary lavage in removing ^{239}Pu decreased with time after exposure and/or with increasing number of lavage sessions. It is estimated that about 50 percent of the initial alveolar lung burden of $^{239}PuO_2$ would have been removed, had both sides of the lung been lavaged. (UK)

9634 POSSIBLE MECHANISM IN BRONCHOPULMONARY LAVAGE. Morken, D. A. (Univ. of Rochester, NY). Health Phys.; 29: No. 5, 790-791(Nov 1975).

A new treatment of data previously reported by Boeker et al. (Health Phys.; 26: 505 (1974)) of bronchopulmonary lavage of dogs is presented. In this treatment the fraction of total removable material which remained in the lung at the end of each 1 litre collection of saline is shown from which a half-value of wash volume of about 1.3 litre is obtained. Resulting from this approach a new mechanism in bronchopulmonary lavage is suggested. If this wash-out process is a reasonable explanation of the phenomenon observed, useful conclusions can be made about the method and its importance when applied to the removal of radioactive particles from the lung. (UK)

9635 FRACTIONAL RADON RETENTION IN BONE. Mays, C. W.; Lloyd, R. D.; Van Dilla, M. A. (Univ. of Utah, Salt Lake City). Health Phys.; 29: No. 5, 761-765(Nov 1975).

Radon-to-radium ratios have been measured in defleshed, canned, and frozen bones of 50 beagles dying 5 to 2988 days after the intravenous injection of ^{226}Ra. The expression Rn/Ra equals (0.075 +- 0.010)t/sup 0.158 +- 0.004/ (1 - e/sup -0.181 t/) at t days describes the dependence of the Rn/Ra ratio in these bones upon time after administration, and was shown to be independent of age at injection or relative injected activity. This equation also appears valid for dogs that received their radium in six equal injections spaced over a period of 280 days, when t is considered as time after midinjection, at least when the time after mid-injection exceeds the duration of injections. Comparison of results for dogs with those reported for mice, rats, chinchillas, and humans showed that about 68 percent of the individual values for these other species were within +- S. D. of the equation for beagles. This suggests that skeletal Rn/Ra ratios as a function of time may be somewhat species independent. Therefore, these ratios depend almost exclusively upon the time following radium deposition. (auth)

9636 COMPARATIVE METABOLISM OF RADIONUCLIDES IN MAMMALS. IX. Retention of ^{75}Se in the Mouse, Rat, Monkey, and Dog. Furchner, J. E.; London, J. E.; Wilson, J. S. (Los Alamos Scientific Lab., NM). Health Phys.; 29: No. 5, 641-648(Nov 1975).

Whole-body retention of ^{75}Se-selenite in mice, rats, dogs, and monkeys was determined with 4 pi liquid scintillation counters after oral and intravenous injection in all species and after intraperitoneal injection in mice and rats. More than 90 percent was absorbed from the gut in all species but monkeys, where much less was absorbed. Retention was described by the sum of three exponentials in all species, whatever the route of administration. Effective half-times of the long components increased with body weight. Radiation protection guides were estimated to be smaller by factors of 3 to 10 than those proposed by the ICRP in 1959. (auth)

9637 THICKNESS OF THE DEPOSITS OF PLUTONIUM AND RADIUM AT BONE SURFACES IN THE BEAGLE. Schlenker, R. A.; Marshall, J. H. (Argonne National Lab., IL). Health Phys.; 29: No. 5, 649-654(Nov 1975).

The thickness of the initial deposit of ^{239}Pu at endosteal bone surface in a beagle dog was found to be less than or equal to 0.2 mu m 90 days after injection of monomeric ^{239}Pu. For ^{226}Ra the thickness of the endosteal surface deposit was found to be less than or equal to 6.5 mu m 5 hr after injection. The thicknesses were determined by measuring the energy loss of alpha-particles emitted from the bone surfaces. If ^{239}Pu were deposited in uniform concentration to a depth of 0.2 mu m, then the rate of escape of alpha-particle energy from the surface would be 98 percent of that from a plane surface source of infinitesimal thickness. For ^{226}Ra uniformly deposited to a depth of 5 mu m, the energy escape would be 76 to 81 percent of that from surface source of infinitesimal thickness, depending on the assumption made about retention of daughter products. (auth)

9638 UPTAKE OF TECHNETIUM FROM SEAWATER BY RED ABALONE HALIOTIS RUFESCENS. Spies, R. B. (Univ. of California, Livermore). Health Phys.; 29: No. 5, 695-699 (Nov 1975).

Technetium accumulation from seawater by the abalone Haliotis rufescens was studied with ^{95}Tc. Concentration factors, uptake rates, steady state concentrations, and biological half-lives were determined experimentally for whole-body uptake. Whole-body concentration factors ranged from 135 to 205; biological half-life was 60 days. Changes in concentration factors were determined for six tissues during the uptake period. The highest activities were in the order of: digestive gland > gill > kidneys > heart > gonad > columnar muscle. Dead shells accumulated little activity compared to shells of living abalone. Gills and digestive system appear to be the routes of entry. Autoradiography shows that of the muscular tissues the outer edge of the foot and epipodium are the most active and the edible columnar muscle the least active. (auth)

9639 INFLUENCE OF INJECTION ROUTE AND pH VALUE ON THE ACTIVITY RATIO OF YTTRIUM-90 TO STRONTIUM-90 IN THE RAT SKELETON AFTER ^{90}Sr INCORPORATION. Stevenson, A. F. G. (Laboratorium fuer Experimentelle Radiologie, Neuherberg, Ger.). Health Phys.; 29: No. 5, 788-789(Nov 1975).

The results of an investigation of the effects of route of administration and pH value, on the internal behavior of a dose of ^{90}Sr-^{90}Y in equilibrium, when injected into rats, are reported. The dependence of the activity ratio of ^{90}Y: ^{90}Sr (Q), in the rat femur, on the pH of the injected solution is shown graphically. The values of Q obtained in the femur after intravenous, intraperitoneal, intramuscular, and subcutaneous adminstration are shown as a function of time. The results are discussed. (UK)

9640 DISTRIBUTION OF ^{239}Pu IN MALE CBA MICE AFTER INTRAVENOUS AND INTRAPERITONEAL INJECTION. Green, D.; Howells, G. R.; Humphreys, E. R. (Medical Research Council, Harwell, Eng.). Health Phys.; 29: No. 5, 798-799(Nov 1975).

Experiments which have been carried out to investigate the deposition of ^{239}Pu in mouse tissues (liver, femur, testis) are reported and repudiate the previously held opinion that direct

comparison can be made between animals which have been injected intravenously and intraperitoneally. (UK)

9641 SUBCELLULAR DISTRIBUTION OF ^{239}Pu IN RAT LIVER PARENCHYMAL CELLS AFTER EXPOSURE IN VIVO AND IN VITRO. Gurney, J. R.; Taylor, D. M. (Kent State Univ., OH). Health Phys.; 29: No. 5, 655-661(Nov 1975).

A study has been made of the subcellular distribution of ^{239}Pu in rat liver parenchymal cells exposed to the nuclide in vitro and in similar cells derived from rats exposed to plutonium in vivo. It has been shown that the subcellular distribution in cells exposed to ^{239}Pu in vivo and in vitro is different: liver cells exposed in vivo show a lysosomal association of the nuclide while in liver, or L5178Y mouse leukaemia, cells exposed in vitro the ^{239}Pu is associated with the cell nucleus. Thus, it is not possible to extrapolate from the results obtained from studies on the interaction between actinides and tissue in vitro to mechanisms by which cells and tissues handle plutonium in vivo. (auth)

9642 DISTRIBUTION OF CADMIUM IN DEVELOPING TEETH AND BONE OF YOUNG RATS. Bawden, J. W.; Hammarstroem, L. E. (Lund Univ., Sweden). Scand. J. Dent. Res.; 83: 179-186 (1975).

$^{109}Cadmium$ was injected intraperitoneally into 10-d-old rats. The rats were terminated at 1, 4, 24 and 96 h postinjection. Distribution of the tracer was studied by autoradiographic techniques, with particular attention directed to the dental tissues. Considerable accumulation of ^{109}C occurred in the cells of the enamel organ and to a lesser degree in the odontoblasts. Slight uptake of the tracer in the enamel and dentin was observed. The injected cadmium was also accumulated in the growing bone. Microautoradiography seemed to indicate that the isotope was preferentially localized in the osteoblasts. (auth)

Plants

9643 MEASUREMENT OF ^{59}Fe IN PLANT MATERIALS USING CHERENKOV RADIATION. Kannan, S. (Bhabha Atomic Research Centre, Bombay.) Int. J. Appl. Radiat. Isot.; 26: No. 9, 557-558(Sep 1975).

Iron-59 is both a β and γ emitting isotope, having a V_{max} of 0.4 MeV for β. A liquid scintillation technique for counting ^{59}Fe in plant materials by Cerenkov radiation using a wavelength shifter, 7-amino - 1,3-naphthalene-disulfonic acid (ANDA) is described. The technique was found to be reliable and comparable to the assay by γ radiation. The main attraction of counting by Cerenkov radiation is that it can be carried out in the conventional liquid scintillation spectrometers which have automatic sample changers and printout of results, and therefore are very well suited and more accessible than conventional gamma-ray spectrometers, for large scale routine measurement programmes. (UK)

9644 DISCRIMINATION OF CALCIUM AGAINST STRONTIUM IN PLANTS WITH A CRYPTATING AGENT. Isermann, K.; Glatzle, A. (Hohenheim Univ. (F. R. Germany). Abt. fuer Pflanzenernaehrung). Naturwissenschaften; 62: No. 5, 238(May 1975).

1 fig.; 7 refs.

The effects of cryptating agents are studied in $^{45}CaCl_2$- and $^{90}SrCl_2$-labelled seedlings of bush beans. The cryptating agent used was Kryptofix 222 (4, 7, 13, 16, 21, 24-Hexaoxa-1, 10, diazobicyclo-8, 8, 8-hexacosan). Kryptofix 222 induces a discrimination in favor of Ca against Sr chelation. The Sr^{2+} concentration in the substrate is thus reduced as well as Sr^{2+} uptake as compared to Ca^{2+} uptake. This is the indirect reason why Kryptofix 222 is able to increase the Ca/Sr ratio in plants. (GE)

9645 PREPARATION OF ^{14}C-GOSSYPOL BY INCORPORATION OF ACETATE-1-^{14}C AND ACETATE-2-^{14}C BY BIOSYNTHESIS. Smith, F. H. (North Carolina State Univ., Raleigh). J. Am. Oil Chem. Soc.; 5: No. 9, 410-412(Sep 1974).

Details for the germination of cotton seedlings and their utilization for incorporating ^{14}C-labeled acetate into gossypol are presented. Methods for the isolation and purification of the biosynthesized gossypol are given. The specific activity of the gossypol obtained from root tissue and cotyledons had mean values for 8 preparations of 428.6×10^3 and 6.3×10^3 dpm/mg, respectively. Corresponding incorporations were 5.42 and 0.32 percent. (auth)

New Tracer Techniques

Refer also to abstracts 8840, 8983, 8996, 9315, 9323–9325, 9330–9332, 9572, and 9614.

9646 (CENA-BT-003) ENZYME ASSAYS INVOLVING THE PRODUCTION OF $^{14}CO_2$. Sodek, L.; Crocomo, O. J.; Basso, L. C. (Centro de Energia Nuclear na Agricultura, Piracicaba (Brazil)). Sep 1974. 24p. INIS.

Radioisotopes have played an exceptional role in many areas of biochemistry, especially in metabolism. The usefulness of the radioisotope is also being appreciated in the assay of enzymes. The main advantage of measuring enzyme activity with radioactive substrates is the very high sensitivity, limited only by the specific radioactivity of the substrate available. Enzyme-catalyzed reactions involving the formation of CO_2 in particular lend themselves to the radioassay technique, since CO_2 being a gas, is readily separated from the rest of the reaction mixture. When the reaction is carried out in a Katz flask, the CO_2 produced may simply be absorbed by some basic substance and subsequently counted. The use of the Katz flask technique for measurement of enzyme activity was first reported by CROCOMO and FOWDEN (1970), for the assay of alanine decarboxylase of cucumber and Ecballium. The method has since been adapted by us for the assay of other enzymes from plants. In this report some examples of enzyme assays based on the Katz flask technique are presented, together with a discussion of the methodology. (INIS)

9647 INFORMATION PROCESSING IN SCINTIGRAPHY. Proceedings of the Third International Conference, Cambridge, Massachusetts, 6–9 June 1973. Metz, C. E.; Pizer, S. M.; Brownell, G. L. (eds.). (Massachusetts Inst. of Tech., Cambridge (USA)). 1973. 215p. Dep. NTIS $7.60.

Separate abstracts were prepared for the 16 papers. (CH)

For abstracts of individual papers see: 9648–9663.

9648 (CONF-730687-, pp 1-6) PARAMETER ESTIMATION FOR DYNAMIC RADIOTRACER STUDIES. Snyder, D. L. (Washington Univ., St. Louis). 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

Some on-going investigations of parameter estimation for radiotracer studies are outlined. These investigations are aimed at identifying an efficient computational algorithm for implementing maximum likelihood parameter estimates, at identifying a model which accounts for non-deal effects such as deadtime found in real scintillation detectors, and at identifying a model for including the spatial as well as the temporal aspects of the problem. (auth)

9649 (CONF-730687-, pp 7-27) PARAMETER ESTIMATION IN CLINICAL NUCLEAR MEDICINE STUDIES. Brill, A. B.; Price, R. R.; Patton, J. P.; Erickson, J. J.; Ivancevic, D. (Vanderbilt Univ., Nashville). 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

The advent of sophisticated computerized data acquisition systems in nuclear medicine has provided a voluminous amount of dynamic scintigraphic data. The problem at hand is the interpretation of these data into meaningful diagnostic information. It is pointed out that there are a number of difficulties one normally encounters in this endeavor and how we and others have chosen to cope with these problems is indicated. We have suggested: the use of multiple views of a radionuclide distribution for improved accuracy of quantitation, the use of simulation modelling analysis for complicated systems, the arbitrary selection of symmetric regions of interest when no a priori reason to select a particular region is available, and the use of potentially powerful statistical tests such as the analysis of variance or factor analysis to detect anomalous regions when on adequate model is available. (auth)

9650 (CONF-730687-, pp 28-61) MATHEMATICAL MODEL FOR IN VIVO MEASUREMENT OF METABOLIC RATES USING EXTERNALLY MONITORED RADIOTRACERS. Larson, K. B.; Raichle, M. E.; Phelps, M. E.; Grubb, R. L. Jr.; Welch, M. J.; Ter-Pogossian, M. M. (Washington Univ., St. Louis, MO). 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

A mathematical model was developed for analyzing data from in vivo metabolism studies based on external monitoring of radioisotopes used to label pharmaceuticals injected into the circulation. Our method is atraumatic, depending only on intravenous injection of two radiotracers and on continuous sampling of arterial blood via catheter from a peripheral site. One injection is of labeled sub-

strate; the other, of a labeled nondiffusible vascular tracer. Following each injection, radioactivities in the organ of interest and in sampled arterial blood are monitored by two external radiation detectors. Thus, for each study, four detector response curves are obtained. The purpose of the second injection is to allow unextracted vascular radioactivity, and by difference, tissue radioactivity, to be determined in the organ of interest. The equations of the model show how tissue radioactivity is related to uptake and utilization of unlabeled substrate in the organ. We have developed algorithms based on these equations for processing the four response curves in order to compute the metabolic utilization rate and other parameters of interest. These algorithms can be implemented on a digital minicomputer if so desired. We have validated our model in a particular application by measuring brain glucose metabolism in live rhesus monkeys, noting the agreement between the results of our method and those of an independent (though traumatic) technique. In conclusion, we discuss possible applications of our model in studies of other metabolic systems. (auth)

9651 (CONF-730687-, pp 64-66) METHOD OF ITERATIVE SECTION SEPARATION IN TOMOSCINTIGRAPHY. Schmidlin, P. (German Cancer Research Center, Heidelberg). 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

A method of iterative section separation based on the observation of the radiating object from different directions is described. Applications in tomographic scintiscanning using gamma or positron cameras are discussed. (CH)

9652 (CONF-730687-, pp 67-79) TOMOGRAPHY AND THE RECONSTRUCTION OF IMAGES FROM THEIR PROJECTIONS. Todd-Pokropek, A. (University College Hospital Medical School, London). 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

A series of methods exists to reconstruct section scan data, being either iterative, using a filter, or by using a two-dimensional Fourier transform. It appears that, provided the system has been correctly set up with appropriate sampling intervals and reasonable signal-to-noise, any of these techniques will give good images. The clinical results so far seem to indicate that such a technique as section scanning can be of some value in refining the diagnosis that may be obtained from conventional brain scanning, which it does not in any way replace. Particular help has been obtained when dealing with lesions of the posterior fossa. (auth)

9653 (CONF-730687-, pp 82-92) TWO-STAGE NONLINEAR FILTER FOR PROCESSING OF SCINTIGRAMS. Pistor, P.; Hoener, J.; Walch, G. (IBM Scientific Center, Heidelberg). 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

Linear filters which have been successfully used to process scintigrams can be modified in a meaningful manner by a preceding non-linear point operator, the Anscombe-transform. The advantages are: The scintigraphic noise becomes quasi-stationary and thus independent of the image. By these means the noise can be readily allowed for in the design of the convolutional operators. Transformed images with a staticnary signal-to-noise ratio and a nonconstant background t correspond to untransformed images with a signal-to-noise ratio that varies in certain limits. The filter chain automatically adapts to these changes. Our filter has the advantage over the majority of space-varying filters of being realizable by Fast Fourier Transform techniques. These advantages have to be paid for by reduced signal amplitude to background ratios. If the background is known, this shortcoming can be easily by-passed by processing trendfree scintigrams. If not, the filter chain should be completed by a third operator which reverses the Anscombe-transform. The Anscombe-transform influences the signal-to-noise ratio of cold spots and of hot spots in a different way. It remains an open question if this fact can be utilized to directly influence the detectability of the different kinds of spots. (auth)

9654 (CONF-730687-, pp 93-101) RESULTS OF NONLINEAR AND NONSTATIONARY IMAGE PROCESSING. Pizer, S. M. (Univ. of North Carolina, Chapel Hill); Correla, J. A.; Chesler, D. A.; Metz, C. E. 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

A nonstationary method, multiple z-divided filtering, and a nonlinear method, biased smearing have been applied to scintigrams. Biased smearing does not appear to hold much promise. Multiple z-divided filtering, on the other hand, appears to be justified, and initial results at minimum encourage further research into the possibility that this technique may become a method of choice. (auth)

9655 (CONF-730687-, pp 102-114) NONLINEAR FREQUENCY DOMAIN TECHNIQUES FOR ENHANCEMENT OF RADIONUCLIDE IMAGES. Kirch, D. L.; Brown, D. W. (Denver Veterans Administration Hospital, Colorado). 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

A digital filtering technique for resolution enhancement of radionuclide images is described, which is termed adaptive enhancement. This is a nonlinear frequency domain approach which seeks to optimize the smoothing function applied to image data based on knowledge of the image power spectrum alone. This approach has been motivated by the difficulties experienced in attempting to find a linear smoothing filter which works well for the entire class of radionuclide images being processed. A method for performing spectral extrapolation is then applied. A departure from inverse MTF enhancement filters is also described. (auth)

9656 (CONF-730687-, pp 115-124) IMPROVEMENT OF GAMMA CAMERA DATA PROCESSING DUE TO SEQUENTIAL ACQUISITION. DiPaola, R.; Bazin, J. P.; DiPaola, M. (Institut Gustave-Roussy, Villejuif, France). 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

The advantages of sequential radionuclide scan data acquisition compared to incremental collection for gamma camera events have become increasingly apparent. Computerized systems allow one to choose the mode of data collection, and hence are presumably more powerful than systems restricted to a single mode. To emphasize the possibilities provided by sequential acquisition, three applications are described. (CH)

9657 (CONF-730687-, pp 125-136) RECONSTRUCTING PICTURES FROM SAMPLED DATA. Bone, D.; Pullan, B. R.; Taylor, C. J. (Manchester Royal Infirmary, Eng.). 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

Corrections for two important degrading effects in gamma ray imaging systems are described. The adaptive local operator has the advantage that given the assumptions of the method the optimum correction is made for both sources of error simultaneously. The probability operator method although less soundly based in classical signal processing theory does make more use of the known statistical properties of possible inputs and consequently might make a better estimate of the true sample values. A separate correction would need to be made for blurring effects. The initial results indicate that the methods are worthy of further investigation. (auth)

9658 (CONF-730687-, pp 140-152) QUANTITATIVE EVALUATION OF HUMAN VISUAL DETECTION PERFORMANCE USING EMPIRICAL RECEIVER OPERATING CHARACTERISTIC CURVES. Metz, C. E.; Goodenough, D. J. (Center for Radiologic Image Research, Chicago). 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

A basic problem in scintigraphy which will become increasingly important as new imaging devices and new image processing techniques are introduced is that of objectively evaluating any given imaging procedure in terms which will permit meaningful comparison of procedures. Since the clinical usefulness of any scintigraphic image depends upon the ability of human observers to extract information from it, and since the relationship between physical parameters of an image and the ability of human observers to perceive features in the image is not at all clear at present, meaningful conclusions regarding the relative quality of images produced by two procedures can only be decided empirically by measuring the ability of human observers to reach correct decisions after

viewing the images. A method of observer performance analysis originally introduced in the field of radar detection and now common in psychophysics is measurement of a Receiver Operating Characteristic (ROC) Curve, which is essentially a plot of the conditional probability of true positive decisions regarding the presence or absence of a signal in the visual field (i.e., probability of a positive response given that a signal is present) versus the conditional probability of false positive decisions (i.e., probability of a positive response given that no signal is present) as the observer's detection threshold or degree of conservatism in calling a questionable situation positive is varied. The possibility of employing ROC curves for evaluation of medical decision making and evaluating radiographic screen-film systems for detection of small image details is discussed. (auth)

9659 (CONF-730687-, pp 153-158) OBSERVER PERFORMANCE AS A MEASURE OF GOODNESS IN THE EVALUATION OF SCINTIGRAPHIC IMAGE PROCESSING. Knowles, L. G.; Kohlenstein, L. C.; Schulz, A. G. (Johns Hopkins Univ., Silver Springs, MD). 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

Evaluation by human observers seems to be the only really viable method of establishing the worth of the many types of radionuclide image processing. Someday links between mathematical formulations and human performance will become established. When those links are available, the effect of parametric variation in system processing details may be more readily evaluated in a meaningful way, but until these are available, we are constrained and in fact, obligated to using real observers evaluating numerous examples of representative scans. (auth)

9660 (CONF-730687-, pp 159-168) PROGRESS REPORT ON THE IAEA CO-ORDINATED RESEARCH PROGRAMME ON THE INTERCOMPARISON OF COMPUTER-ASSISTED SCINTIGRAPHIC TECHNIQUES. Lewis, B.; Nagai, T. (International Atomic Energy Agency, Vienna). 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

The studies at present being carried out under this Program, which has 18 participating centers, are intercomparisons of data-processing techniques for radionuclide image enhancement, particularly as regards their relative merits in improving the detectability of small lesions. It is emphasized that these intercomparisons are not intended to lead to the establishment of a single optimal data-processing technique. It is also emphasized that they have so far been limited to techniques for the digital processing and display of static images. (auth)

9661 (CONF-730687-, pp 173-188) USE OF THE WALSH TRANSFORM FOR SCINTIGRAM ENHANCEMENT. Jolley, T. M. Jr. (Franklin McLean Memorial Research Inst., Chicago); Pizer, S. M. 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

The Discrete Walsh Transform (DWT) can be used to reduce the computation time requirements of discrete circular real convolution in the processing of radionuclide images. The standard implementation of discrete convolution uses a forward Fast Fourier Transform (FFT), application of a transfer function (filter) in the Fourier or frequency domain, and an inverse FFT. An alternate approach has been proposed which uses a forward DWT, a linear transformation in the Walsh or sequency domain, and an inverse DWT. This paper is particularly concerned with the computational advantages of the latter approach for the implementation of two-dimensional discrete circular convolution. Utilizing the patterned sparsity and symmetry of the silter matrices, the siltering procedure yields a very good approximation of the desired convolution result while requiring significantly fewer multiplications than the standard implementation of convolution using the FFT or convolution speedup algorithms. (auth)

9662 (CONF-730687-, pp 191-194) COMPARISON OF THE DETECTABILITY OF SMALL LESIONS IN POLAROID PICTURES AND ELECTRO-STATIC PRINTER PLOTTER DISPLAY. Erbsmann, F. (Hospital Universitaire St. Pierre, Brussels). 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

Display techniques play an important role in the digital handling of scintigraphic data. Most investigators in the field adapt their mathematical procedures to the quality of their display. In the recent IAEA coordinate research program on the intercomparison of scintigraphic techniques, however, no clear cut difference was made between mathematical method and display technique. Different computer displays are discussed and evaluated. (CH)

9663 (CONF-730687-, pp 195-203) NEW HARD-COPY COLOUR DISPLAY SYSTEM USING INK-JETS AND ITS APPLICATION IN NUCLEAR MEDICINE. Gustafsson, T. (University Hospital, Lund, Sweden). 1973.

From third international conference on data handling and image processing in scintigraphy; Cambridge, Massachusetts, USA (6 Jun 1973).

In information processing in scintigraphy. (Massachusetts Inst. of Tech., Cambridge (USA)).

Normally, the color radionuclide scan scale is linear and the colors are arranged in spectral order, since this approach yields the smallest contrast between successive colors and because a human observer can remember this color sequence easily. The color scale can also be multi-cycled, but the number of cycles should not be too great, since as the number of cycles increases, the display approaches a contour map, and the analog properties of the picture are lost. Many cycles also mean that the differentiation between hot-spots and cold-spots can be ambiguous. Besides pictorial images, colors have been used with good results for coding functional images such as those arising from dynamic studies, dual isotope images, and transmission-emission images. A number of different color display techniques in use today are described and compared. (CH)

9664 (CONF-7410127-(Absts.)) SIXTH ANNUAL CONFERENCE OF SOCIETY OF NUCLEAR MEDICINE, BOMBAY, INDIA, 11-13 OCTOBER 1974. Abstracts. (Society of Nuclear Medicine, Delhi (India)). 1974. 27p. Society of Nuclear Medicine, Bombay, India.

Brief summaries are presented for 54 papers presented that discuss recent advances in nuclear medicine. Emphasis was placed on methods to supplement studies of ^{131}I uptake for the diagnosis of thyroid dysfunction. (CH)

9665 (CONF-750465-2) RECONSTRUCTION TOMOGRAPHY FROM INCOMPLETE PROJECTIONS. Oppenheim, B. E. (Chicago Univ., Ill. (USA). Dept. of Radiology; Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). 1975. 46p. Dep. NTIS $5.00.

From workshop on reconstruction tomography in diagnostic radiology in nuclear medicine; San Juan, Puerto Rico (17 Apr 1975).

In some instances, reconstruction radionuclide tomography must be carried out from projections that do not include projection values for all portions of the object to be reconstructed. This may occur, for example, when the field of view of the detector is limited, or when an opaque foreign body is present within the object. The effects of such incomplete projections upon reconstructions of computer-simulated phantoms were studied, using iterative and convolution methods. Several methods for reducing the resulting artifacts and inaccuracies are discussed. (auth)

9666 CELL COMPOSITION OF THE RED PULP OF MICE. II. Electronmicroscopic and Autoradiographic Investigations on Megakaryocytes. Yamashita, K.; Helpap, B. (Bonn Univ. (F. R. Germany). Pathologisches Inst.). Virchows Arch. Abt. B.; 16: No. 4, 347-361(1974). (In German).

9 figs.; 1 tab.; 29 refs.

A cytokinetic and morphological analysis of the megakaryocytes in the mouse spleen was performed with autoradiographic and electron-microscopic methods. It could be shown that the percentage cell distribution, the percentage of ^{3}H-thymidine labeled cells, and the transitional time of each type (I, IIa, IIb, III) of megakaryocytes in the mouse spleen are essentially similar to the findings reported in the bone marrow of the mouse and rat. Radioactive labeled mature megakaryocytes (type IIa, IIb, III) were not observed 1 h after injection of ^{3}H-Thymidine, whereas all types of megakaryocytes show an almost 100% labeling index after 2 to 3 days. Furthermore, it could be shown that the megakaryocyte originates through a maturation process from a large basophilic cell, which is 100% labeled 1 h after pulse labeling with ^{3}H-thymidine and is electron-microscopically very similar to the youngest form of the megakaryocyte type I. (auth)

9667 STUDIES ON THE DURATION OF THE NUCLEAR DNA SYNTHESIS IN THE BUCCAL MUCOSA OF ADULT MALE RATS. II. Autoradiographic Investigations In Vitro. Schmid, G. H.; Schell, H.; Horstein, O. P.; Fischer, U.; Stosieck, C. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Derma-

tologische Klinik Mit Poliklinik). Virchows Arch. Abt. B.; 17: No. 2, 177-184(1974). (In German).

4 figs.; 21 refs.

In in vitro studies on the duration of the nuclear DNA synthesis, various environmental factors that may influence functions of the excised tissue must be considered before the results can be compared to those obtained under in vivo conditions. Based on our earlier in vivo study on the length of the S phase in buccal mucosa epithelium of rats, we investigated the effect of various in vitro conditions on the ^{3}H-index and the S phase (T_s) of the same tissue in 32 adult male Sprague Dawley rats. The average of the ^{3}H-index of the buccal mucosa epithelium incubated in vitro under suitable and constant conditions differs only slightly from that of the surviving animals. The most suitable temperature for incubation as indicated by the average height of the ^{3}H-index, is 37°C. DNA synthesis is influenced by the length of incubation time inasmuch as the ^{3}H-index does not increase between the 60th and the 180th min. As after 3 hours labelled mitoses cannot be observed, the G_2 phase of the cell cycle is also assumed to be delayed. Using the in vitro technique of double labelling by ^{3}H-thymidine, we calculated the duration of DNA synthesis in one of the animals to be almost 9 hours and in the other about 16 hours, respectively. (GE)

9668 AUSAB TEST: A RADIOIMMUNOASSAY IN THE SOLID PHASE FOR THE DETECTION OF ANTIBODIES AGAINST HBsAg. Lange, W.; Koehler, H.; Apodaca, J. (Bundesgesundheitsamt, Berlin (F. R. Germany). Robert Koch-Institut). Zentralbl. Bakteriol. Parasitenkd., Abt. I. Orig.; 229: No. 4, 423-428(1974). (In German).

1 tab.; 8 refs.

The suitability of a newly developed RIA (Ausab test, Abbott Laboratories) for the detection of antibodies against the Hepatitis B (surface) antigen (HBsAg) has been tested on 1,968 sera of blood donors. Reproducibility test and specificity test were included. During the examination the technique of the Ausab test was changed from the original one-step to the two-step procedure. With the one-step technique 431 of 1,968 sera (21.9%) showed positive reactions. During the test problems concerning the differentiation between positive and negative results were encountered due to high unspecific binding of radioactivity. Positive sera were reexamined employing the two-step technique and only 77.4% of the previously positive reactions could be reproduced. The 50 sera that were negative in the one-step test remained negative in the two-step test. Difficulties concerning nonspecific binding of radioactivity as observed with the one-step technique were not encountered with the two-step procedure. On 92 of the confirmed positive sera a specificity test was run and 90 (97.8%) proved to be specific. (auth)

9669 INTEGRATION OF PALMITAT-1-^{14}C IN LECITHIN AND PHOSPHOLIPID CONTENT IN NORMAL AND MICRO-EMBOLIZED RABBIT LUNGS. Study Model of the So-Called Shock Lung. von Wichert, P.; Wilke, A.; Gaertner, U. (Hamburg Univ. (F. R. Germany). Medizinische Klinik). Anaesthesist; 24: No. 2, 78-83(Feb 1975). (In German).

5 tabs.; 26 refs.

Glass microspheres were used for a diffuse pulmonary microembolization, as a model for shock lung. Microembolization is regarded as an important factor in pathogenesis of shock lung. The capacity of lung for lecithin synthesis was measured with palmitat-1-^{14}C incorporation. The phospholipid content and the composition of the fatty acids of lecithin were investigated. From the results it was possible, that the surfactant system may alterated by the vascular blocking. The dates supporting the importance of microembolization in pathogenesis of shock lung are given. (auth)

9670 INCORPORATION OF RADIOACTIVE PYRIMIDIC PRECURSORS INTO THE DEOXYRIBONUCLEIC ACIDS OF CHLORELLA PYRENOIDOSA. Dalmon, J.; Bayen, M.; Rode, A. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. de Biologie Vegetale). Z. Pflanzenphysiol.; 74: No. 3, 189-199(1975).

4 figs.; 2 tabs.; 21 refs.

(2-^{14}C) thymidine is incorporated into the nuclear and chloroplastic DNAs of Chlorella pyrenoidosa, strain Emerson. (me-^{14}C) thymidine is incorporated into chloroplastic DNA, but never into nuclear DNA. The radioactivity is still found to be associated with thymine. When the cultures are supplied with (2-^{14}C) uracil, both DNAs are radioactive and the radioactivity is found to be associated with thymine, cytosine, and, for the nuclear DNA, 5-methylcytosine. (2-^{14}C) deoxycytidine is also incorporated into both DNAs, but their specific activity is very low. These results suggest that thymidine is specifically incorporated into chloroplastic DNA of the strain Emerson. In the case of the nuclear DNA, they suggest the existence of a thymidine demethylation mechanism, probably localized in the cytoplasm. (auth)

9671 LABELED METRONIDAZOLES AS POTENTIAL NEW AGENTS FOR AMEBIC HEPATIC ABSCESS IMAGING. Tubis, M.; Krishnamurthy, G. T.; Endow, J. S.; Stein, R. A.; Suwanik, R.; Blahd, W. H. (Veterans Administration Hospital, Los Angeles, Calif. (USA). Nuclear Medicine and Research Services; University of Southern California, Los Angeles (USA). School of Pharmacy; California Univ., Los Angeles (USA). Dept. of Medicine). Nucl.-Med.; 14: No. 2, 163-171(Jun 1975).

3 figs.; 10 refs.

Two new radiopharmaceuticals were developed as possible agents for demonstrating the presence of hepatic amebic abscesses by selective accumulation of these agents in the abscess contents. These agents are: ^{131}I-labeled Bromometronidazole, that has been shown to possess some of the antibiotic activity of metronidazole or Flagyl; and a technetium 99m-penicillamine-Flagyl complex. A method of radioiodination has been devised which can be performed in radiopharmaceutical laboratories. Both radiopharmaceuticals are of very low toxicity. Distribution studies in animals show accumulation in the liver and elimination by way of the gallbladder. Scintillation camera studies depict a rapid uptake by the liver with subsequent biliary excretion. Animal models for the study of hepatic amebic abscesses are not available. A human patient with suspected amebic abscesses has been studied with negative findings that were confirmed at surgery. Collaborative studies are now in progress in several areas of the world where amebiases is endemic. (auth)

9672 COMPARATIVE STUDY OF ^{99m}Tc-POLYPHOSPHATE AND ^{99m}Tc-DIPHOSPHONATE. Henne, W.; Pixberg, H. U.; Pfannenstiel, P. (Deutsche Klinik fuer Diagnostik, Wiesbaden (F. R. Germany). Sektion Nuklearmedizin). Nucl.-Med.; 14: No. 2, 83-90(Jun 1975). (In German).

3 figs.; 3 tabs.; 10 refs.

Technetium-99m-labeled phosphates are the bone seeking agents of choice. The comparison of ^{99m}Tc-polyphosphate (Poly-P) and ^{99m}Tc-ethane-1-hydroxy-1,1-diphosphonate (EHDP) shows a better in vitro stability of the latter during the first two hours after preparation. The blood clearance of EHDP is superior to Poly-P resulting in reduced background activity at scanning time. Renal excretion over a 4-hour period of urine sampling showed no significant differences between both substances. Blood activity is independent of diuresis. (auth)

9673 HEPATIC BLOOD FLOW WITH COLLOIDAL ^{198}Au IN THE DIAGNOSIS OF CHRONIC HEPATITIS IN CHILDREN. Marian, L.; Szantay, V. (Institutul de Medicina si Farmacie, Cluj (Romania). Clinica 3 Medicala). Nucl.-Med.; 14: No. 2, 158-162(Jun 1975).

From 2nd symposium on the use of radioisotopes in gastroenterology; Cluj, Romania (4 May 1975). 2 figs.; 8 refs.

Tracer quantities of colloidal ^{198}Au were used to estimate the hepatic blood flow in normal children and in children with active or progressive chronic hepatitis and also to obtain scintigrams of the liver. In active chronic hepatitis a significant decrease in HBF values was observed, suggesting that the method may be used as a diagnostic criterion which is superior to hepatic scintigraphy. In progressive chronic hepatitis HBF values even lower than those in active hepatitis were observed. Together with more characteristic clinical findings and abnormal results of biochemical function tests, they underline the value of the method in estimating the severity and the evolution of the disease. (auth)

9674 DIAGNOSIS OF OSTEOPOROSIS BY MEASUREMENT OF ^{125}I-ABSORPTION OF THE FINGER. Breuel, H. P.; Hesch, R. D.; Henning, H. V.; Emrich, D. (Goettingen Univ. (F. R. Germany). Abt. fuer Nuklearmedizin; Goettingen Univ. (F. R. Germany). Medizinische Klinik und Poliklinik). Radiologe; 15: No. 6, 251-255(Jun 1975). (In German).

4 tabs.; 26 refs.

Quantitative measurement of radiation absorption of an external ^{125}I source does not give information about calcium decrease of the skeletal system in an individual case. Of 50 patients under an age of 40 years who demonstrated osteoporosis by roentgenography, only 19 patients had absorption coefficients of the spongiosa in a pathological range. However there was a significant decrease of the absorption coefficients in two patient collectives with decreased calcium bone diseases. The insufficient diagnostic information in an individual patient is explained by the overlap of absorption values in normals and patients with decreased calcium. This is caused by the difficulties to determine the absorption of the finger and the insufficient discrimination of scattered radiation. (auth)

9675 PRINCIPALS OF HORMONE SUBSTITUTION IN THYRECTOMIZED PATIENTS WITH CARCINOMA OF THE

THYROID GLAND. Huefner, M.; Munzinger, H.; Papke, H.; Barwich, D.; Bahner, F.; Schenk, P.; Roeher, D. (Heidelberg Univ. (F. R. Germany). Medizinische Poliklinik; Heidelberg Univ. (F. R. Germany). Strahlenklinik; Heidelberg Univ. (F. R. Germany). Chirurgische Klinik). Radiologe; 15: No. 6, 245-250(Jun 1975). (In German).

5 figs.; 2 tabs.; 17 refs.

The substitution of thyrectomized patients with carcinoma of the thyroid with L-thyroxin has advantages compared to a substitution with triiodothyronine. 200 μg T_4/d are sufficient to obtain a negative TRH test in most patients. For security it is suggested to perform a general substitution of these patients with 300 μg T_4/d. This dose is very well tolerated. Too high doses of substitution cause a damage of the thyreotrope in part of the patients. This is demonstrated by a transient thyreotropic insufficiency after withdrawl of the substitution. The results demonstrated here suggest that the central suppression of TSH secretion is better correlated with plasma T_4 than plasma T_3 levels. (auth)

9676 BEAM DIAMETER EFFECTS ON LINEAR BONE MASS MEASUREMENT OF BONE ASHLARS. Luethy, H.; Roth, J. (Kantonsspital Basel (Switzerland). Universitaetsinstitut fuer Medizinische Radiologie). Atomkernenergie; 25: No. 3, 204-206(1975). (In German).

6 figs.; 3 refs.

The method of Watt evaluating theoretically the transmitted photon intensities is applied to the measurement of bone ashlars. The calculations are compared with measurements by Iodine-125 photon attenuation. The cross sections area of beam bounded by the collimator size does not cover completely the transition region of the object. Therefore, the result is an underestimation of the measured absorption area. Correction and error factors are presented. (auth)

9677 COMPUTER PROGRAMME SYSTEM FOR THE GRAPHIC EVALUATION OF CLEARANCE CURVES. Klar, M.; Birg, W.; Schrader, H.; Mundinger, F. (Freiburg Univ. (F. R. Germany). Neurochirurgische Klinik). Atomkernenergie; 25: No. 3, 195-198(1975). (In German)

For the evaluation of clearance curves recorded with a gamma camera a new method has been developed that offers a maximum of information on the physiological parameters as well as on their statistical validity by means of a detailed graphic representation of the cerebral blood flow values previously calculated by a computer program. (auth)

9678 PHARMACOKINETICS OF INTRAVENOUS CEFRADIN IN NORMAL AND RESTRICTED RENAL FUNCTION. Hoeffler, D. (Staedtische Kliniken Darmstadt (F. R. Germany). Medizinische Klinik 3); Koeppe, P. (Freie Univ. Berlin (F. R. Germany). Strahleninstitut und -klinik). Muench. Med. Wochenschr.; 117: No. 27, 1169-1174(Jul 1975). (In German)

Half life and distribution volume of Cefradin were investigated in 22 patients with various degrees of renal function in which Cefradin was indicated and set in relation to glomerular function (determined by the ^{51}Cr EDTA method). An average distribution volume of 21.8 ± 3.5% of the body weight was found and a correlation between the half life of Cefradin and the glomerular filtration in the form of a power function. Estimations of levels were made from the pharmacokinetic data (half life, distribution volume) which serve as a basis for the recommendation of isoconcentration dosages. These are graduated according to the different degrees of renal insufficiency and given in tabular form for single injections and for continuous infusion drip therapy. (auth)

9679 VALUE OF RADIOIMMUNO-ASSAY OF TRIIODOTHYRONINE AND THYROTROPIC HORMONE IN THE DIAGNOSIS OF THYROID DISEASE. Hesch, R. D.; Emrich, D.; von zur Muehlen, A.; Breuel, H. P. (Goettingen Univ. (F. R. Germany). Medizinische Klinik und Poliklinik; Goettingen Univ. (F.R. Germany). Radiologische Klinik und Poliklinik). Dtsch. Med. Wochenschr.; 100: No. 15, 805-812(Apr 1975). (In German)

Results of a purely in-vitro test were compared with previously available methods in 425 patients. For triiodothyronine, a normal range must be differentiated from the so-called euthyroid range (0.8 to 2.0 ng/ml) for patients with euthyroid goitre. The accuracy for triiodothyronine is then more than 95% and in hyperthyroidism 97.5%. It is, therefore, superior to other in-vitro measurements. But a disadvantage is that it is easily influenced by thyroid and extrathyroid factors. Similar accuracy is obtained for the TRH function test (thyrotropine-releasing hormone). Notable is a negative TRH test in 20% of patients with euthyroid goitre. The significance of triiodothyronine determination is decreased in autonomous adenoma in which the TRH test has an accuracy of 96.5%. In rare diseases of the thyroid all diagnostic possibilities must be taken into account. In ordinary practice a stepwise course is suggested. RT_3U, T_4, T_3, and thyroid scan with ^{99m}Tc pertechnetate are useful as basic tests. PBI is still thought to be important. The second step involves the TRH test rather than ^{131}I function test. Triiodothyronine determination is best for therapeutic and follow-up purposes, a situation in which TRH test is of limited value. (auth)

9680 ANGIOSCINTIPHOTOGRAPHY WITH ^{99m}Tc IN 310 CASES OF SPACE-OCCUPYING KIDNEY LESIONS. Tori, G.; Marabini, A.; Franchi, R.; Giorgetti, P. G. (Instituti Ospitalieri, Verona (Italy). Servizio di Medicina Nucleare). Nucl.-Med.; 14: No. 2, 133-143(Jun 1975).

Angioscintiphotography, as a simple method of visualizing the blood flow through vessels and organs, utilizing the scintillation camera and rapid sequential frames, was proposed for the first time in 1966. This method found practical application in the radionuclide diagnosis of space-occupying kidney lesions. In the past five years (1969 to 1973) we have studied, in cooperation with our Departments of Urology and Surgery, more than four hundred cases of suspected space-occupying lesions of the kidney. We selected only 310 cases for this study. All of them were confirmed by surgical operation or autopsy and histologically proven. (auth)

9681 SOFT TISSUE CONCENTRATION OF ^{99m}Tc-TIN-PHOSPHATE COMPLEXES. Buell, U.; Lieven, H. V.; Leisner, B. (Muenchen Univ. (F.R. Germany). Klinik und Poliklinik fuer Radiologie). Nucl.-Med.; 14: No. 2, 91-105(Jun 1975). (In German)

The concentration of ^{99m}Tc-pyrophosphate was determined in the lower extremities of rabbits (normal, abacterial and bacterial affected soft tissues), in osteoarthritis of the hip joint (capsule and muscle) as well as in knee joint effusions. Compared with the ^{85}Sr-concentration reflecting the calcification capacity concentrations of ^{99m}Tc-pyrophosphate in soft tissues were found to be lower 2 hours p.i., but were up to elevenfold higher 24 hours p.i. These findings should be due to a fixation of ^{99m}Tc-pyrophosphate in collagen containing tissues as in the soft tissue tumors (myosarcoma, synovialioma, breast cancer) presented. A mechanism of delayed equilibration could explain augmented uptake in lymphedema, ascites, and effusions in florid osteoarthritis of the knee joint. The possible dependence of ^{99m}Tc-pyrophosphate concentration in bone and soft tissue on collagenous contents is discussed. (auth)

9682 RAT-LIVER CHOLESTEROL 7α-HYDROXYLASE. I. Development of a New Assay Based on the Enzymic Exchange of the Tritium Located on the 7α Position of the Substrate. van Cantfort, J.; Renson, J.; Gielen, J. (Liege Univ. (Belgium). Service de Chimie Medicale, Toxicologie et Hygiene). Eur. J. Biochem.; 55: No. 1, 23-31(Jun 1975).

A new assay is described to measure the activity of cholesterol 7α-hydroxylase and compared to the conventional ^{14}C method used by other investigators. This method is based on the mechanism of the enzymic hydroxylation, i.e. a direct and stereospecific substitution of the 7α-hydrogen by a hydroxyl group. [7α-^{3}H] cholesterol is incubated at 37°C and in the presence of molecular O_2 in a medium buffered by potassium phosphate at pH 7.4 and containing liver microsomes (or 9,000 × g supernatant), NADPH, $MgCl_2$ and cysteamine. Tween-80 (1.5 mg/ml) is used to introduce enough substrate (300 μM) in the incubation mixture to saturate the enzyme (K(m) = 100 μM). Under these conditions the tritiated water released into the incubation medium reflects accurately the enzymic activity. The results obtained with this method are similar to the one obtained with a [4-^{14}C] cholesterol technique ($r = 0.96$; $P < 0.001$). The main advantage of the [7α-^{3}H] cholesterol method is a complete independence from further metabolism of the first enzymic product, the 7α-hydroxycholesterol, the tritiated water representing the entire cholesterol 7α-hydroxylase activity. (auth)

9683 PHOTOINACTIVATION AND CARBETHOXYLATION OF LEUCINE AMINOPEPTIDASE. Ludewig, M.; Frohne, M.; Marquardt, I.; Hanson, H. (Martin-Luther-Universitaet Halle-Wittenberg, Halle (German Democratic Republic). Physiologisch-Chemisches Inst.). Eur. J. Biochem.; 54: No. 1, 155-162(May 1975).

In the present paper the reactivity of histidyl residues of leucine aminopeptidase from bovine eye lens was studied by dye-sensitized photooxidation and by carbethoxylation of the enzyme protein using diethylpyrocarbonate. Of all the different amino acids modified by photooxidation only histidine is connected with the enzymic activity, whereas tyrosine seems to be involved in structure stabilization. By changing the pH and varying the effectors (Mg^{2+} and/or dodecylsulfate) of the reaction mixture a different number of histidyl residues of the enzyme protein is

caused to react with diethylpyrocarbonate. No secondary reactions with tyrosyl or tryptophyl residues could be observed by spectrophotometric investigations. The enzyme modified by one of the above-mentioned methods shows changes in the capacity of Mn^{2+} binding measured by autoradiography as well as in the degree of enhancement of enzymic activity by Mn^{2+} or Mg^{2+} ions. Of the 48 histidyl residues of the enzyme (M_r = 326,000) up to two histidyl residues per subunit (M_r = 54,000) may be involved in Mn^{2+} or Mg^{2+} binding and up to four histidyl residues have a strong influence on Zn^{2+} binding. (auth)

9684 QUANTITATIVE ^{125}I-AUTORADIOGRAPHY OF INDIVIDUAL CELLS. Thiel, E.; Doermer, P.; Eulitz, M. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Muenchen (F.R. Germany). Inst. fuer Haematologie). Histochemie; 43: No. 1, 33-49(1975). (In German)

Iodine-125 is investigated for its applicability in quantitative autoradiography. Absorption and geometric factors of radiation are elucidated. The simultaneous exposure of radioactive standard sources permits the evaluation of absolute amounts of radioactivity. Standard cells with labelled membranes are a suitable source of reference taking into account the physical properties of the isotope. Sheep red blood cells are examined for their suitability as standard cells after enzymatic radioiodination. The absolute number of antigenic substances on the surface of single cells is obtained by determining the specific activity of the labelled antibody molecules and by measuring the silver grain densities of the cells under investigation and of the standard cells. The new method is applied to the quantification of membrane-bound immunoglobulin molecules of the IgG-type on single human lymphocytes. On the lymphocytes of a normal person and of a patient with chronic lymphatic leukemia quite different amounts of immunoglobulins have been evaluated. (GE)

9685 ^{99m}Tc-SULFUR-RHENIUM COLLOID AND ^{111}In-INDIUM CITRATE IN THE BONE MARROW SCINTIGRAPHY. Glaubitt, D.; Haberland, K.; Knoch, K.; Fejer, F. L.; Zachariah, S. (Staedtische Krankenanstalten Krefeld (F.R. Germany). Inst. fuer Nuklearmedizin; Staedtische Krankenanstalten Krefeld (F. R. Germany). Medizinische Klinik). Blut; 30: No. 3, 213-221 (Mar 1975). (In German)

Bone marrow scintigraphy using ^{111}In-citrate and ^{99m}Tc-sulfur-rhenium colloid was compared with each other in six male and three female patients. The results in all patients were in favor of ^{111}In-citrate which caused a better delineation of morphological details than ^{99m}Tc-sulfur-rhenium colloid did. In the first days after intravenous administration of ^{111}In-citrate, radioindium accumulated markedly in the pudendal region, this finding being more distinct in male patients than in female ones. On account of these results a considerable radiation dose has to be assumed in bone marrow scintigraphy using ^{111}In-citrate as long as the absorbed dose from ^{111}In has not been estimated under consideration of the radioindium accumulation in the pudendal region. The ^{111}In-citrate should be applied in bone marrow scanning only exceptionally and ^{99m}Tc-sulfur-rhenium colloid should be preferred in the routine diagnostics of bone marrow. (auth)

9686 AUTORADIOGRAPHIC DEMONSTRATION OF HUMAN BASOPHIL GRANULOCYTES. Arndt, D.; Parwaresch, M. R.; Bodenstein, H. (Kiel Univ. (F.R. Germany). Pathologisches Inst.). Blut; 30: No. 3, 199-202(Mar 1975). (In German)

A new technique is described which enables a selective tinctorial visualization of human blood basophils in autoradiographic preparations. Consecutive administration of 5-aminoacridine hydrochloride and aldehyde fuchsin rendered a sufficient preservation of basophils preventing leaching of their water soluble granules. Extensive control tests provided sufficient evidence to exclude chemographic artifacts produced by other histochemical procedures. The technique eliminates the obstacles to study the kinetics of human blood basophils and their relationship to atopic hypersensitivity reactions applying tritiated thymidine and radioiodine labeled IgE or corresponding antisera. (auth)

9687 EFFECT OF PITUITARY GONADOTROPHINS ON TRITIATED THYMIDINE UPTAKE BY RAT OVARY. An Autoradiographic Study. Nakano, R.; Mizuno, T.; Katayama, K.; Hayashi, K.; Tojo, S. (Kobe Univ. (Japan). Dept. of Obstetrics and Gynecology). Arch. Gynaekol.; 218: No. 1, 1-9(1975).

The effect of follicle-stimulating hormone (FSH) and luteinizing hormone (LH) on the follicular growth in the ovary of the hypophysectomized rat was investigated using autoradiography. The numbers of DNA-synthesizing nuclei in the granulosa cell were measured by autoradiography after flashlabelling with tritiated (^{3}H) thymidine. The frequency of ^{3}H-thymidine labelled nuclei in the granulosa cell enhanced in the presence of FSH. In contrast, LH had no significant effect on thymidine uptake. The result suggests that FSH stimulates follicle cell division, whereas LH does not. (auth)

9688 CHANGES IN GUINEA-PIG DERMAL COLLAGEN DURING DEVELOPMENT. Shuttleworth, C. A.; Forrest, L. (Manchester Univ. (UK). Dept. of Medical Biochemistry). Eur. J. Biochem.; 55: No. 2, 391-395(Jul 1975).

Guinea-pig dermis was digested with pepsin and the solubilized collagen molecules separated by differential salt precipitation at pH 7.5. Differences in subunit composition and amino acid analysis were noted between type I and type III collagen. Incorporation of radioactive proline into the developing fetus enabled isolation of labelled type I and type III collagens. Comparison of the specific activity of the isolated collagen molecules showed that type III collagen had a high specific activity in the early stages of fetal development, which decreased dramatically during fetal development. The specific activity of pepsin-solubilized type I collagen remained fairly constant during fetal development. (auth)

9689 METABOLISM OF ^{14}C-LABELED PHENYLALANINE AND TYROSINE IN MALARIA-INFECTED CULEX-FEMALES. Maier, W. A.; Nassif-Makki, H. (Bonn Univ. (F.R. Germany). Inst. fuer Medizinische Parasitologie). Z. Parasitenkd.; 46: No. 1, 69-74(1975). (In German)

Culex females are fed on ^{14}C-phenylalanine or ^{14}C-tyrosine in sugar solution. Autoradiographic studies on homogenated females 1 or 4 days after feeding show that the labeled amino acids are metabolized on the first day and are not detectable on the fourth day. After increase of the amino acid concentration by saturation of the sugar solution with the unlabeled amino acid, the labeled acid and its metabolites are visible over a longer period of time. Phenylalanine is metabolized to tyrosine and at least four other substances. Radioactivity on the starting point of the chromatogram can be interpreted as incorporation of tyrosine into proteins. After infection with Plasmodium cathemerium, and feeding of ^{14}C-phenylalanine, ^{14}C-tyrosine is demonstrable over a longer period. (auth)

9690 INTRARENAL DISTRIBUTION OF ^{125}I-ALBUMIN IN THE SYRIAN HAMSTER. Moeller, P.; Taugner, R. (Heidelberg Univ. (F.R. Germany). 1. Physiologisches Inst.). Pfluegers Arch.; 354: No. 3, 241-248(1975).

The intrarenal distribution of radioiodinated human serum albumin (^{125}RISA) after intravenous injection was studied in Syrian hamsters by scintillation counting and frozen section autoradiography. Frozen section autoradiography indicated that the distribution of radioalbumin in the renal cortex of the Syrian hamster is limited mainly to the kidney vessels, being especially noticeable in the glomerular capillaries. Toward the papilla increasingly greater (mainly extratubular) activity could be observed not only intravascularly but also interstitially. In the cortex of the rat kidney, on the other hand, radioactive albumin was accumulated (probably by filtration and reabsorption) predominantly in the proximal tubular epithelium. Within 30 min the kidneys of the rat excreted more than 10 times as much ^{125}I than the hamster kidneys. These results (substantially less cortical accumulation and urinary excretion or radioalbumin in the Syrian hamster) indicate that, in contrast to the rat, obviously much less albumin is filtered (and then accumulated by proximal reabsorption) by the Syrian hamster glomeruli. This suggests that the Syrian hamster kidney is more suitable than the rat kidney for determining the interstitial, cortical, albumin space. (GE)

9691 RADIOACTIVE LABELLING AND CHARACTERIZATION OF THE PRODUCTS OF ACTIVATED MOUSE LYMPHOCYTES. Sorg, C. (Muenster Univ. (F.R. Germany). Abt. fuer Experimentelle Dermatologie). Eur. J. Biochem.; 55: No. 2, 423-430 (Jul 1975).

For chemical characterization of the products of activated lymphocytes a radioactive double-label technique was developed which allows one to distinguish those products synthesized either de novo or in increased amounts by the stimulated culture. Spleen cells from Balb/c mice were cultured in serum-free medium in the presence or absence of concanavalin A and simultaneously labelled with radioactive leucine. Optimal culture conditions were established by determining parameters such as cell density, mitogen concentration, and kinetics of protein synthesis following stimulation. Combined supernatants of stimulated and unstimulated cultures each labelled with either [^{3}H]leucine or [^{14}C] leucine were fractionated on Sephadex G-75. Materials derived from control or stimulated supernatants both yielded a qualitatively similar radiolabelled profile. The isotope ratio of stimulated to nonstimulated culture, however, showed a broad peak at K_D 0 to 0.35 (approximately mol. wt. 75,000 to 20,000)

which was further analyzed by isoelectric focusing. Pools of every two fractions were focused in polyacrylamide gels at pH 3.5 to 10. By determining the isotope ratio, the isoelectric point, and the K_D (mol wt), it was possible to distinguish at least 24 molecules which had been produced only, or in greater degree, by the stimulated culture. (auth)

9692 INVESTIGATION OF THE CIRCULATION OF THE CEREBROSPINAL FLUID WITH ^{111}In DTPA. Moretti, J. L. (Hopital Henri-Mondor, 94—Creteil (France)). Electromedica; 43: No. 2, 86-91(1975). (In German)

Indium-111-DTPA is very suitable as a radiopharmaceutical for the investigation of the cerebrospinal circulation in the case of brain tumors. Its kinetics are good regarding the cerebrospinal circulation, and by its gamma radiation and its gamma energy a good external palpation is possible. It shows no chemical toxicity, and its biological and physical half-life is well suited to the investigation time of the patients. (GE)

9693 INVESTIGATION OF FLOW THROUGH END ARTERIES IN DISEASES OF DIGITAL VESSELS USING RADIO-ACTIVE TRACERS (ARTERIAL OCCLUSIVE DISEASE, ACROSCLEROSIS, AND SCLERODERMIA). Tiedjen, K. U.; Piaszek, L. (Essen Univ. (Gesamthochschule) (F.R. Germany). Angiologische Abt.; Essen Univ. (Gesamthochschule) (F. R. Germany). Abt. fuer Nuklearmedizin). Fortschr. Geb. Roentgenstr. Nuklearmed.; 123: No. 1, 56-66(Jul 1975). (In German)

Using ^{113m} indium chloride and an Anger scintillation camera, flow rates were measured and recorded in defined distal parts of the hand. The method is a useful complement to previous diagnostic techniques and provides information regarding flow through end-arteries which cannot otherwise be obtained. Because of the low risk, even of intra-arterial injection of the tracer substance, isotope angiography can be used as a means of controlling operative and conservative treatment. (auth)

9694 CAMERA-CINEMATOGRAPHY OF THE HEART. Adam, W. E.; Meyer, G.; Bitter, F.; Kampmann, H.; Bargon, G.; Stauch, M. (Ulm Univ. (F.R. Germany). Dept. Radiologie; Ulm Univ. (F.R. Germany). Sektion fuer Cardiologie und Angiologie). Fortschr. Geb. Roentgenstr. Nuklearmed.; 123: No. 1, 19-26(Jul 1975). (In German)

By camera-cinematography of the heart, we mean an isotope method which permits detailed observation of cardiac mechanics without the use of a catheter. All that is necessary is an intravenous injection of 10 to 15 mCi ^{99m}Tc-human serum albumin followed after ten minutes by a five to ten minute period of observation with a scintillation camera. At this time the isotope has become distributed in the blood. Variations in the precordial impulses correspond with intra-cardiac changes of blood volume during a cardiac cycle. Analysis of the R-wave provides adequate information of cyclical volume changes in limited portions of the heart. This is achieved by a monitor with a pseudo-3-dimensional display; contraction and relaxation of the myocardium can be shown for any chosen longitudinal or horizontal diameter of the heart. Our program allows simultaneous presentation of the movement of any point on the myocardium as a time-activity curve. The method is recommended as an addition to chest radiography, heart screening, or cardiac kymography before carrying out cardiac catheterization. (auth)

9695 METHODS OF FUNCTIONAL SCINTIGRAPHY OF THE HEART: THE EFFECT OF THE RADIOPHARMACEUTICAL AGENTS. Breuel, H. P.; Emrich, D. (Goettingen Univ. (F.R. Germany). Abt. fuer Nuklearmedizin). Fortschr. Geb. Roentgenstr. Nuklearmed.; 123: No. 1, 37-40(Jul 1975). (In German)

Functional scintigrams of the heart were performed in 63 patients using different injection techniques and two radiopharmaceuticals (^{99m}Tc-pertechnetate and ^{99m}Tc-human serum albumin). A comparison of the results shows that injection of ^{99m}Tc-human serum albumin into the femoral vein gave the best results. Injection of the tracer into the femoral vein causes less dilution of the bolus than the usual injection technique into the cubital vein. There is less recirculation of the indicator resulting in lower co-efficients of variation of the quantitative parameters. The choice of ^{99m}Tc-human serum albumin facilitates demarcation of the individual cardiac chambers. (auth)

9696 MICROSCOPIC TRACING OF DEUTERIUM. Kisieleski, W.; Ringo, R. (Argonne National Lab., IL). J. Microsc.; 104: 199-204(Jul 1975).

The development of the ion microprobe analyser has made it possible to follow stable isotopes with microscopic resolution in biological and other materials. An ion microprobe using an oxygen primary beam has been found to produce relatively few mass 2 ions (+ or −) on organic samples. This technique should permit the use of deuterium as a practical tracer with a resolution of about 1 μm in the plane of the section and 2 nm in the depth dimension with available instruments. (auth)

9697 LABORATORY CULTURE FOR ^{14}C-LABELING OF CHLORELLA AND OEDOGONIUM. Krzywicka, A. M.; Wagner, G. H. (Missouri Univ., Columbia). Int. J. Appl. Radiat. Isot.; 26: No. 9, 515-518(Sep 1975).

Algae were cultured in experiments that attained efficient CO_2 utilization permitting ^{14}C-labeling of cells and that compared growth characteristics of unicellular Chlorella sp. and filamentous Oedogonium sp. Culture vessels were 500 ml glass tubes through which air enriched to 5% CO_2 was slowly metered. The tubes, used in a vertical position for growing Chlorella, were filled with culture medium and the cells kept in suspension using a magnetic stirrer. Tubes placed horizontally and half filled with medium were used for Oedogonium permitting the algae to grow at the liquid-air interface. Maximum yield was 3 g/1. in 5 days for Chlorella and 1 g/0.51. in 10 days for Oedogonium. Efficiency and rate of CO_2 fixation, cell size, and cell weight for two algae are evaluated. (auth)

9698 LABELING OF PROTEINS WITH ^{125}I AND EXPERIMENTAL DETERMINATION OF ITS SPECIFIC ACTIVITY. Caro, R. A. (Buenos Aires Univ.); Ciscato, V. A.; De Giacomini, S. M. V.; Quiroga, S.; Radiocella, R. (Buenos Aires Univ.). Int. J. Appl. Radiat. Isot.; 26: No. 9, 527-532(Sep 1975).

The purpose of the present work consists of the standardization of the Chloramine-T labeling technique of proteins with ^{125}I and the control of the obtained products, principally their specific activities, in order to utilize them correctly in radioimmunoassays. The quantities of Chloramine-T and sodium metabisulphite were lowered, with regard to the original method, to 3.6 and 9.6 μg respectively. Under these conditions, optimal yields and radioiodinated proteins with good immunological activities were obtained. (auth)

9699 ^{99m}Tc ASCORBATE. Preparation, Quality-Control, and Quantitative Renal Uptake in Man. Persson, R. B. R.; Strand, S. E.; White, T. (Lund Univ., Sweden). Int. J. Nucl. Med. Biol.; 2: No. 3, 113-122(Jul 1975).

The Tc-ascorbate preparation (with Tc-99m) used in this investigation contained $FeCl_3$ 4mM, ascorbic acid 110 mM and had an initial pH-value of 7.4 and a final pH-value of 6.8. Studies of the complex-formation were performed with gel-chromatography column-scanning (GCS), which is the analytical method to be preferred for this type of compound, indicated that the complex was formed in two steps. First reduced hydrolyzed Tc was formed rapidly and the Tc-ascorbate was formed by a slower reaction ($k = 3.\ 10^{-2}$ min^{-1}). The renal uptake of Tc- was studied in 29 patients with a gamma-camera. The time-course of radio-activity in kidneys, tissue background-areas, and in blood suggested that optimal conditions for kidney-imaging were reached 3 to 6 hr after injection. About 20 per cent of the Tc-ascorbate was bound to plasma-proteins, and only a small fraction to red blood-cells. The disappearance of the Tc-ascorbate from plasma followed a three-exponential curve: 40% with a half-life of 0.2 hr, 30% with a half-life of 2 hr, and 30% with a half-life of 20 hr. The absorbed radiation dose to the kidneys was about 200 (SE ± 60) mrad mCi^{-1} and to the whole-body 10 (SE ± 3) mrad mCi^{-1} of administered activity. There was a close correlation ($r + 0.98$) of the separate renal uptake [(dx:(dx + sin))] of Tc-ascorbate to the separate renal function as determined with ^{131}I-Hippuran. (auth)

9700 RADIOIODINE ESCAPE IS AN UNEXPECTED SOURCE OF RADIOIMMUNOASSAY ERROR AND CHRONIC LOW LEVEL ENVIRONMENTAL CONTAMINATION. Bogdanove, E. M.; Strash, A. M. (Virginia Associated Research Center, Blacksburg). Nature (London); 257: No. 5525, 426-427(2 Oct 1975).

Reference is made to the use of proteins and peptides labelled with radioiodine in radioimmunoassays and other investigational procedures. Decomposition of such labelled molecules can liberate iodide ions, which remain in solution, but the liberation of elemental radioiodine appears not to have been reported. The studies described here, however, imply that under conditions common in many radioimmunoassay laboratories, appreciable quantities of gaseous radioiodine can escape from radioimmunoassay tubes, leading to errors and to low level environmental contamination. Precautions are described for minimizing this problem. (UK)

9701 COMPARISON OF FOUR TECHNIQUES FOR LABELLING ALBUMIN MICROSPHERES WITH ^{99m}Tc. Mayron, L. W.; Kaplan, E. (Veterans Administration Hospital, Hines, IL). Int. J. Nucl. Med. Biol.; 2: No. 2, 74-80(Mar 1975).

The labeling of microspheres of human serum albumin with technetium-99m has been evaluated for binding efficiencies and specific activities of the complexes. The techniques used were electrolysis, ferric ion and sodium ascorbate (Fe-Asc), stannous ion, or thiosulphate, together with sodium pertechnetate. The effects of centrifugation and settling, and also of weight of the sample of microspheres (1 to 40 mg) were studied. Tenacity of

labeling was estimated by cycles of sonification, washing and filtration for each of the labeling procedures and for commercial microspheres. The most stable labeled microsphere preparation came through the processing of the thiosulphate method. Lung imaging studies on rats, using labeled and washed microspheres, 1 to 2 μCi, injected into the tail vein, showed that more than 95% of the radioactivity was found in the lungs, i.e. all the microspheres had gone to the lungs. The maximum binding efficiency obtained by electrolysis was 74%, by Fe-Asc was 91%, by stannous ion was 92%, and by thiosulphate was 83%. (UK)

9702 POSITRON RANGES OBTAINED FROM BIOMEDICALLY IMPORTANT POSITRON-EMITTING RADIONUCLIDES. Cho, Z. H.; Chan, J. K.; Ericksson, L.; Singh, M.; Graham, S.; MacDonald, N. S.; Yano, Y. (Univ. of California, Los Angeles). J. Nucl. Med.; 16: No. 12, 1174-1176(Dec 1975).

Positron ranges were obtained experimentally for several nuclides used in scintigraphic imaging. The nuclides examined were ^{11}C, ^{13}N, ^{15}O, ^{18}F, ^{68}Ga, and ^{82}Rb. The results are discussed with respect to the ultimate spatial resolution obtained in a scintigraphic image. (auth)

9703 MEASUREMENT OF ACUTE MYOCARDIAL INFARCTS IN DOGS WITH /sup 99m/Tc-STANNOUS PYROPHOSPHATE SCINTIGRAMS. Stokely, E. M.; Buja, L. M.; Lewis, S. E.; Parkey, R. W.; Bonte, F. J.; Harris, R. A. Jr.; Willerson, J. T. (Parkland Memorial Hospital, Dallas). J. Nucl. Med.; 17: No. 1, 1-5(Jan 1976).

Myocardial scintigrams using /sup 99m/Tc-stannous pyrophosphate (/sup 99m/Tc-PYP) can be used to measure myocardial infarcts produced in dogs by proximal ligation of the left anterior descending coronary artery. Seven dogs had /sup 99m/Tc-PYP myocardial scintigraphy performed 24 to 32 hr after ligation of the proximal left anterior artery. In each dog the scintigrams showed increased /sup 99m/Tc-PYP uptake in the distribution of the artery. The scintigraphically visible areas of infarction, measured using interactive computer-aided techniques, were compared subsequently with independent histologic measurements of myocardial infarct size. Several methods for using the area measurements to estimate infarct size were treated. The most successful method (r equals 0.92, p less than 0.01) assumed a linear relationship between the largest scintigraphic infarct area and the histologically determined infarct weight. The results suggest that /sup 99m/Tc-PYP myocardial scintigrams provide a useful noninvasive method for measuring infarct size in dogs with proximal ligation of the left anterior descending coronary artery. (auth)

9704 TRANSIENT BRAIN SCAN ABNORMALITIES IN RENAL DIALYSIS PATIENTS. Wolfstein, R. S.; Tanasescu, D. E.; Waxman, A. D.; Siemsen, J. K. (Univ. of Southern California Medical Center, Los Angeles). J. Nucl. Med.; 17: No. 1, 6-8(Jan 1976).

Two patients on chronic renal hemodialysis developed acute neurologic symptoms and unusual brain scan findings, including very prominent cranial sinuses. Symptoms and scan abnormalities reverted to normal within a few days. The possible mechanisms are discussed. (auth)

9705 CERVICAL VENOUS REFLUX IN DYNAMIC BRAIN SCINTIGRAPHY. Hayt, D. B.; Perez, L. A. (Misericordia Hospital Medical Center, Bronx, NY). J. Nucl. Med.; 17: No. 1, 9-12(Jan 1976).

Cervical venous reflux, shown by dynamic brain scintigraphy, was investigated through three avenues of approach: by reviewing 371 randomly chosen routine dynamic intracerebral bloodflow studies to estimate its incidence; by correlative positive-contrast superior venacavography in patients with characteristic cervical venous reflux; and by performing dynamic brain scintigraphy while utilizing various positional and physiologic maneuvers to attempt to produce cervical venous reflux in patients who did not exhibit this phenomenon on earlier examination. Although any obstruction of the superior vena cava or a properly timed Valsalva maneuver in selected patients can produce the scintigraphic picture of cervical venous reflux, in most cases it is a normal phenomenon due to incompetent or absent cervical venous valves. (auth)

9706 EVALUATION OF THE POSTERIOR FLOW STUDY IN BRAIN SCINTIGRAPHY. Martin, T. R.; Moore, J. S.; Shafer, R. B. (Veterans Administration Hospital, Minneapolis). J. Nucl. Med.; 17: No. 1, 13-16(Jan 1976).

To evaluate the usefulness of the posterior radionuclide cerebral flow study, a prospective study was instituted. Of 32 adult patients examined for presumed posterior disease, 17 were found to have a positive posterior flow study that yielded information not available from the anterior study. Indications for posterior flow studies include posterior parietal, occipital, and posterior fossa tumors, posteriorly located arteriovenous malformations, Paget's disease involving occipital bone, posterior cerebral infarcts, and sagittal sinus occlusions. Our experience indicates that the posterior flow study is a valuable adjunct in those patients carefully screened for suspected posterior cerebral disease. (auth)

9707 THYROID CARCINOMA PRESENTING AS A PERTECHNETATE "HOT" NODULE, BUT WITH ^{131}I UPTAKE: CASE REPORT. Turner, J. W.; Spencer, R. P. (Wesson Memorial Hospital, Springfield, MA). J. Nucl. Med.; 17: No. 1, 22-23(Jan 1976).

A 24-year-old woman presented with a mass on the right side of the neck; this proved to be a hyperfunctioning or hot nodule on /sup 99m/Tc-scan. Because of the firmness of the area, the study was repeated with ^{131}I, but the region did not accumulate radioiodide. The tissue showing this discrepant handling of pertechnetate and radioiodide was surgically removed and identified as a follicular carcinoma with papillary foci. A brief review of the literature data on the disassociation of thyroid trapping and organification functions, and hence of possible discrepancies between pertechnetate and radioiodide uptake, is given. (auth)

9708 VERTEBRAL ARTERY FISTULA DETECTED BY RADIONUCLIDE ANGIOGRAPHY: CASE REPORT. Rockett, J. F.; Moinuddin, M.; Robertson, J. T.; Bernard, S. C. (Baptist Memorial Hospital, Memphis). J. Nucl. Med.; 17: No. 1, 24-25(Jan 1976).

Dynamic scintigraphy after intravenous bolus injection of /sup 99m/Tc-pertechnetate was applied to the study of the head and neck. This procedure has proved useful in detecting occlusive vascular lesions, particularly in the carotid and middle cerebral arteries. These occlusive vascular lesions appear as decreased perfusion. Here we report a vertebral artery fistula that was evident as increased activity in the neck vessel distribution during the dynamic study. (auth)

9709 ABNORMAL RADIONUCLIDE ANGIOGRAM IN CERVICAL LYMPHADENITIS: CASE REPORT. Stevens, J. S.; Mishkin, F. S. (Charles R. Drew Postgraduate School, Los Angeles). J. Nucl. Med.; 17: No. 1, 26(Jan 1976).

Increased activity over the neck was observed on radionuclide angiograms of two patients with cervical lymphadenitis. This incidental finding should not be confused with other causes of locally increased perfusion. (auth)

9710 EFFECT OF UNILATERAL PULMONARY HYPOVASCULARITY ON THE BONE SCAN: CASE REPORT. Preisman, R.; Halpern, S. E. (Rees Stealy Clinic, La Jolla, CA). J. Nucl. Med.; 17: No. 1, 27-28(Jan 1976).

Two patients who had decreased pulmonary artery blood flow to the right lung showed increased clarity of rib detail on a bone scan over the affected hemithorax as contrasted with the uninvolved side. Decreased blood background is postulated to a result in enhancement of rib detail on the affected side. (auth)

9711 OVARIAN CARCINOMA IMAGED BY /sup 99m/Tc-PYROPHOSPHATE: CASE REPORT. Gates, G. F. (Stanford Medical Center, CA). J. Nucl. Med.; 17: No. 1, 29-30(Jan 1976).

An ovarian carcinoma which avidly accumulated /sup 99m/Tc-pyrophosphate was imaged during a bone scan. The primary tumor and its implants over the liver surface were both visualized. Although imaging of such an ovarian malignancy has not been previously reported, it offers a potential method for assessing neoplastic size and spread. (auth)

9712 FALSE-POSITIVE LIVER SCAN IN A PATIENT WITH HEPATIC AMYLOIDOSIS: CASE REPORT. Suzuki, K.; Okuda, K.; Yoshida, T.; Kanda, Y. (Chiba Univ. School of Medicine, Japan). J. Nucl. Med.; 17: No. 1, 31-32(Jan 1976).

A case of secondary hepatic amyloidosis exhibiting a large liver and multiple defects on the ^{198}Au-radiocolloid scintigraph is presented. Biopsy and angiographic studies indicated that the areas of reduced colloid uptake represented heavy amyloid deposition, and the area of the left lobe with contrasting high activity most probably represented compensatory hypertrophy. (auth)

9713 GALLBLADDER VISUALIZATION IN ADRENAL SCANNING: CASE REPORT. Harbert, J. C.; Canary, J. J.; Sandock, K. L. (Georgetown Univ. Hospital, Washington, DC). J. Nucl. Med.; 17: No. 1, 33-35(Jan 1976).

A patient suspected of having adrenal hyperfunction was scanned with ^{131}I-iodocholesterol. Intense gallbladder activity persisted for several days and was eliminated by a fatty meal. The possibility of confusion with unilateral adrenal localization is discussed. (auth)

9714 TECHNETIUM-99m-PYRIDOXYLIDENEGLUTAMATE, A NEW AGENT FOR GALLBLADDER IMAGING COMPARISON WITH ^{131}I-ROSE BENGAL. Kubota, H.; Eckelman, W. C.; Poulose, K. P.; Reba, R. C. (Washington Hospital Center, Washington, DC). J. Nucl. Med.; 17: No. 1, 36-39(Jan 1976).

Two agents used for hepatobiliary studies, ^{131}I-rose bengal and

/sup 99m/Tc-pyridoxylideneglutamate, have been compared in rabbits. The /sup 99m/Tc radiopharmaceutical is rapidly cleared from the blood by the liver and rapidly excreted through the common bile duct into the duodenum. Because of its rapid removal from the liver, visualization of the gallbladder and biliary passages was obtained within 15 min after injection in experimental animals. (auth)

9715 IN VIVO BEHAVIOR OF /sup 99m/Tc-FIBRINOGEN AND ITS POTENTIAL AS A THROMBUS-IMAGING AGENT. Harwig, S. S. L.; Harwig, J. F.; Coleman, R. E.; Welch, M. J. (Edward Mallinckrodt Inst. of Radiology, St. Louis). J. Nucl. Med.; 17: No. 1, 40-46(Jan 1976).

We have investigated the in vivo behavior of /sup 99m/Tc-fibrinogen, prepared by a mild and efficient electrolytic method employing tin electrodes. The clearance mechanisms of this agent were studied, and its efficacy for imaging deep-vein thrombi in dogs with an Anger camera was determined. The /sup 99m/Tc-fibrinogen preparations, which are stable in vitro, undergo partial rapid exchange of the technetium with other plasma proteins and with anions of the blood buffer system in vivo, resulting in an early drop in the percent of radioactivity associated with clottable protein. However, very little or no oxidation to pertechnetate occurs. The nonclottable material is much more rapidly cleared from the blood than the remaining /sup 99m/Tc-fibrinogen, and the proportion of clottable protein activity increases with time. The fraction of /sup 99m/Tc-fibrinogen that remains intact in vivo is biologically active and will incorporate into thrombi. Higher thrombus-to-blood activity ratios are obtained with /sup 99m/Tc-fibrinogen than with radioiodinated fibrinogen when both agents are injected into dogs 4 hr after induction of femoral vein thrombosis. Clearly delineated images of the thrombi are obtained, beginning about 2.5 hr after injection. Thus, /sup 99m/Tc-fibrinogen may be of clinical use as a thrombus-imaging agent in patients undergoing active thrombosis, especially in regions of high blood pool. (auth)

9716 UNRELIABILITY OF COMBINED PNEUMOENCEPHALOGRAPHY AND SCINTICISTERNOGRAPHY. Milhorat, T. H.; Chien, T.; Majd, M.; Breckbill, D. L. (Children's Hospital National Medical Center, Washington, DC). J. Nucl. Med.; 17: No. 1, 54-56(Jan 1976).

Evidence is presented that the radiopharmaceutical flow in cerebrospinal fluid may be significantly altered by pneumoencephalography. When both pneumoencephalography and scinticisternography are required in the same patient, the studies should be performed separately rather than as a combined procedure. (auth)

9717 LABELING OF TIN-SOAKED ALBUMIN MICROSPHERES WITH ^{68}Ga. Hnatowich, D. J. (Massachusetts General Hospital, Boston). J. Nucl. Med.; 17: No. 1, 57-60(Jan 1976).

A method is described for the labeling of tin-soaked human serum albumin microspheres with ^{68}Ga. The radionuclide is a short-lived (T/sub 1/2/ equals 68 min) generator product and a positron emitter; the labeled particles may be used for perfusion studies with a positron camera. The labeling procedure requires 40 min after elution of the ^{68}Ga generator and provides a labeling efficiency of 90 +- 5 percent. The in vivo stability of the particles was determined in a series of animal experiments which showed little washout of lung cavity over a 2-hr period. (auth)

9718 INFUSION CISTERNOGRAPHY. Magnaes, B.; Rootwelt, K.; Sjaastad, O. (Oslo Univ. Hospital, Norway). J. Nucl. Med.; 17: No. 1, 65-67(Jan 1976).

A source of error in cerebrospinal fluid (CSF) infusion tests is leakage at the dural puncture site. The addition of a bolus of radionuclide to the infusion fluid was helpful in detecting the existence of leakage as shown by increased infusion pressure in six of eight patients studied with and without scintigraphic evidence of leakage. Comparison of CSF dynamics in 26 patients studied by infusion cisternography and conventional cisternography showed similar patterns, suggesting no alteration of CSF dynamics by the artificial CSF infusion. Combining the two tests, therefore, resulted in simple identification of the leakage and saved the patient time and discomfort. (auth)

9719 RADIOACTIVE LABELING OF alpha-BUNGAROTOXIN WITH TRITIUM. Eterovic, V. A.; Aune, R. G.; Bennett, E. L. (Univ. of California, Berkeley). Anal. Biochem.; 68: No. 2, 394-403(Oct 1975).

alpha-[^{3}H] bungarotoxin (Bgt) was prepared by catalytic reduction of ^{125}I-labeled alpha-Bgt with tritium. Specific activities of 10 to 15 Ci/mmol were attained. The radioactive label was found in tyrosine. Tritiated alpha-Bgt appears to bind specifically to the cholinergic receptor of diaphragm and to a similar component of cerebral cortex. This specificity and the high specific radioactivity attained provide a useful tool for the study of acetylcholine receptor in brain and other tissues with low receptor concentration. (auth)

9720 RADIONUCLIDE IMAGING OF THE CIRCULATORY DISTRIBUTION OF MEMBRANE LUNG PERFUSION. Kanarek, D.; Zapol, W.; Ahluwalia, B.; Qvist, J.; Hales, C.; Liland, A. (Harvard Medical School, Boston). Trans., Am. Soc. Artif. Intern. Organs.; 20A: 262-268(1974).

Extracorporeal gas exchange with membrane lungs is increasingly used to provide supplementary gas exchange for patients with severe acute respiratory failure. It is of great importance to define the anatomical distribution of oxygenated blood delivered to the perfused subject in order to develop perfusion techniques for optimal delivery of oxygenated blood to vital organs such as the brain and heart. We examined changes in the distribution of extracorporeally oxygenated blood caused by independently altering the sites of arterial perfusion and the cardiac output. We studied blood distribution by radionuclide labelling and imaging in experimental lambs and in 3 patients perfused for severe acute respiratory failure. The information obtained allowed us to devise and test new methods of cannulation for better distribution of perfusion. (auth)

9721 ROLE OF ^{67}Ga CITRATE SCANNING IN THE MANAGEMENT OF NON-HODGKIN'S LYMPHOMA. Levi, J. A.; O'Connell, M. J.; Murphy, W. L.; Sutherland, J. C.; Wiernik, P. H. (National Cancer Inst., Baltimore). Cancer; 36: No. 5, 1690-1701(Nov 1975).

Gallium-67 scans were performed as part of the initial evaluation in 45 patients with non-Hodgkin's lymphoma. Eighteen of these patients underwent staging laparotomy and splenectomy. In addition, scans were performed either shortly after therapy was completed or during subsequent followup in 10 patients. The initial scans were found most useful for patients with histiocytic lymphoma: in detecting sites of involvement above the diaphragm and the high para-aortic/mesenteric region, and when tumors were greater than 2 cm in diameter. The addition of ^{67}Ga scanning to the pre-operative clinical evaluation reduced the number of incorrectly staged patients from 8 to 4. Reversion of previously positive ^{67}Ga scans to negative in 3 patients with suspected persistent or recurrent disease was associated with fibrosis and no lymphoma when biopsied. Five other patients had histologically documented positive ^{67}Ga scans post-therapy; in 1 the ^{67}Ga scan was only definitive noninvasive procedure. Despite the occurrence of both false-positive and false-negative ^{67}Ga scans, this procedure appears to be a useful supplement to the pretreatment evaluation of patients with non-Hodgkin's lymphoma, especially the histiocytic form. Confirmation of its ability to detect high para-aortic/mesenteric involvement may subsequently result in a reduction of the number of staging laparotomies necessary. For the post-treatment followup of these patients ^{67}Ga scans may prove to be a valuable noninvasive investigation. (auth)

9722 EFFECT OF DIELDRIN TOXICITY ON ACETATE AND PALMITATE METABOLISM IN RAT LIVER. Kohli, K. K.; Bhatia, S. C.; Venkitasubramanian, T. A. (Delhi Univ.). Environ. Physiol. Biochem.; 5: 119-125(1975).

The effect of a single oral dose of dieldrin (30 mg/kg body weight) on lipid metabolism in rats was studied. Liver lipid content increased and this increase was mainly in the triglyceride fraction. The incorporation of acetate-^{14}C into fatty acids was decreased indicating an inhibition of lipogenesis. Fatty acid oxidation was increased. Palmitate-^{14}C incorporation into the triglyceride fraction was enhanced pointing to an overall increased utilization of fatty acids. (auth)

9723 QUANTITATIVE DETERMINATION OF SPLENIC RED BLOOD CELL DESTRUCTION IN PATIENTS WITH SPLENOMEGALY. Egelund Christensen, B. (Gentofte Hospital, Copenhagen). Scand. J. Haematol.; 14: 295-302(1975).

In order to evaluate a method permitting quantitation of splenic red blood cell destruction, a model of erythrocyte destruction in enlarged spleens was created. Erythrocytes are destroyed in the splenic erythrocyte pool at a constant rate, producing in labelling studies hyperhaemolysis due to random destruction. A mathematical analysis of the model shows that the splenic destruction rate can be calculated with great accuracy from quantitation of the initial excess radioactivity, measured over the spleen during the first days after infusion of ^{51}Cr-labelled autologous erythrocytes. 18 patients with splenomegaly (479-4700 g) were investigated. The splenic erythrocyte destruction rate was estimated to be between 0.5–4.4% of the total erythrocyte mass per day, increasing significantly with increasing splenic weight. The results indicate that erythrocyte destruction takes place almost exclusively in the enlarged spleen in cases of predominant splenomegaly without complicating immunohaemolysis. (auth)

9724 RADIOISOTOPE SCINTIPHOTOGRAPHY IN DIAGNOSIS OF HEPATIC POLYCYSTOSIS AND ITS SURGICAL TREATMENT. Makarenko, T. P.; Kasatkin, J. N.; Esenbaev, S. R. (Central Inst. for the Advancement of Doctors, Moscow). Vestn. Khir.; 113: No. 10, 39-44(Oct 1974). (In Russian).

Scintiphotography by means of a scintillation gamma-chamber was employed for such rarely observed and difficult to diagnose lesions as polycystosis of the liver. The advantages of this technic contrary to a line-scanner are described. Five patients with polycystic affection of this organ were observed. Having analyzed the results of surgical therapy the authors consider the removal (enucleation) of all cysts with a fibrous capsule en block to be rational, since other routine methods of surgical intervention could not prevent the recurrence. (auth)

9725 EXPERIENCE WITH POSITIVE SCAN IN DIAGNOSTICS OF PULMONAL ILLNESS. Chmelik, M.; Pokorna, I. Cesk. Radiol.; 28: No. 6, 404-409(Nov 1974). (In Czech).

Evaluation is presented of results of cumulative pulmonary scans in 156 patients with tumorous and inflammatory illnesses of lungs and mediastinum. There were used ^{75}Se-sodium selenate, ^{197}Hg-mercurichloride, and ^{67}Ga- gallium citrate. The best results were achieved by ^{67}Ga- gallium citrate, where there was the lowest number of deceptively positive as well as negative results. Owing to the fact that the radioisotopes used are not selectively captured by tumorous cells but that there appears cumulation even in inflammatory strata it is necessary to evaluate the results of positive pulmonary scans in agreement with other clinical and laboratory results. (auth)

9726 CLINICAL INFECTIONS DETECTED BY ^{67}Cs SCANNING. Deysine, M.; Robinson, R.; Rafkin, H.; Teicher, I.; Silver, L.; Aufses, A. H. Jr. (Long Island Jewish-Hillside Medical Center, New Hyde Park, NY). Ann. Surg.; 180: No. 6, 897-901 (Dec 1974).

Gallium-67 scintiscanning was utilized in 34 patients suffering from clinically demonstrable infections. The isotope was able to localize infections in soft tissue, bones, and some areas of the abdomen. Its utilization in the diagnosis of pelvic inflammatory disease is complicated by the fact that the isotope is secreted into the bowel and obscures the area. This isotope is ideal for the diagnosis of acute and/or chronic inflammation of bone secondary to open reduction of fractures, and may also be of use in the diagnosis of primary osteomyelitis. (auth)

9727 DIGITAL DATA PROCESSING DURING RADIOISOTOPE SCINTIGRAPHY. Lotter, M. G.; Van Aswegen, A.; Minnaar, P. C.; Iturralde, M. (Univ. of the Orange Free State, Bloemfontein, S. Afr.). S. Afr. Med. J.; 48: No. 59, 2474-2478 (7 Dec 1974). (In Afrikaans).

The features of an on-line image data processing system for nuclear medicine are described. The uses of the system for the processing and evaluation of images, lung function determinations and cardiac studies are mentioned. (auth)

9728 QUANTITATIVE RADIOISOTOPE CARDIOGRAPHY WITH THE SCINTILLATION CAMERA. Van Aswegen, A.; Lotter, M. G.; Minnaar, P. C.; Iturralde, M.; Kleynhans, P. H. T. (Univ. of the Orange Free State, Bloemfontein, S. Afr.). S. Afr. Med. J.; 48: No. 59, 2464-2468(7 Dec 1974). (In Afrikaans).

Methods for obtaining various cardiac parameters, using radioisotopes and the scintillation camera, have improved tremendously during recent years. These investigations offer a simplified screening test for visual interpretation. By the use of numerical techniques, quantitative information can be obtained, making investigations more sensitive. Left-to-right shunts, cardiac output, left ventricular ejection fraction and other parameters can be quantitated. (auth)

9729 ^{85}Sr UPTAKE STUDY IN NON-UNION IN MAN. Segmuller, G.; Bekier, A.; Cech, O. (Univ. Clinic, Prague). Eur. Surg. Res.; 2: 226-232(1970).

A modified technique of external counting of the osteotrope isotope ^{85}Sr was used on patients suffering from non-union of fractures of the tibia. The relative value of increased radioactivity at the site of the pseudarthrotic lesion is expressed by the activity ratio. Recordings at 6 to 7 equally spaced locations of both tibiae were obtained during 1 week after injection of the tracer. Tracer uptake was increased in the diseased tibia immediately after injection. Radioactivity remained high at the site of the lesion, while in normal bone it decreased rapidly. The activity ratio, therefore, increased steadily. The method seems valuable in evaluating the dynamic state of bone repair, but as a clinical entity may not reflect the actual osteogenic potential of the lesion. (auth)

9730 SIMPLE RADIOISOTOPIC TECHNIQUE FOR THE STUDY OF URATE TRANSPORT IN THE RAT KIDNEY. Abramson, R. G.; Levitt, M. F.; Maesaka, J. K.; Katz, J. H. (Mount Sinai School of Medicine, New York). J. Appl. Phys.; 36: No. 4, 500-505(Apr 1974).

To study uric acid transport in single nephrons and whole kidney of the rat, a technique has been developed for the radioassay of uric acid-2-^{14}C in plasma, urine, and tubular fluid. Labeled allantoin, which results from the in vivo oxidation of uric acid-2-^{14}C, is readily separated from the labeled uric acid by a two-step elution from a strongly basic anion exchange resin using column chromatography. It is concluded that this radioassay is a valid technique and that it provides a more sensitive and precise means of measuring U/P uric acid ratios at endogenous plasma uric acid concentrations than does a conventional differential spectrophotometric method. (auth)

9731 RADIOIMMUNOASSAY OF PLASMA AETIOCHOLANOLONE. Youssefnejadian, E.; Virdee, S. S.; Sommerville, I. F. (London Univ.). J. Steroid Biochem.; 5: 529-532(1974).

A rapid procedure is described and evaluated for the determination of free aetiocholanolone (5β-androstan-3α-ol-17-one) in peripheral venous plasma (1.0 ml) of men and women. Tritiated aetiocholanolone is added as internal standard; the plasma extracted with diethyl ether and the extract purified on precoated silica gel plates before radioimmunoassay using an antiserum to aetiocholanolone-3-hemisuccinate-bovine serum albumin. The range of values (mean ± S.D.) in plasma from 40 healthy men was 40.2 ± 23.8 ng/100 ml and the corresponding value for 20 healthy women was 34.5 ± 7.23. (auth)

9732 ECG CHANGES IN SELECTIVE CORONARY ANGIOGRAPHY AND MYOCARDIAL SCINTIGRAPHY. Aldor, V. E.; Heeger, H. (Hanusch-Krankenhaus, Wien, Ger.). Z. Kardiol.; 62: 1078-1084(1973). (In German)

In 50 nonselected patients with coronary heart disease we analyzed the ECG changes which occur during selective coronary angiography. We could show that there is no connection between the degree of the changes and the anatomic substrate in the coronary arteries. It seems that hypoxia cannot be the cause of the ECG response because Ringer Solution and 131-I-albumin did not develop it. Iodine-131-labeled albumin which is used for myocardial scintigraphy shows other characteristics in the electrocardiogram caused by hypoxia. Changes of the myocardial membrane conductance were discussed for the origin of the ECG response on contrast medium. (auth)

9733 DIAGNOSTIC USE OF ^{131}I-UROKINASE. Neidhart, P.; Hofer, B.; Duckert, F.; Fridrich, R. (Universitatsinstituts fuer Medizinische Radiologie, Basel). Schweiz. Med. Wochenschr.; 104: 141-142(26 Jan 1974). (In German)

It is possible to detect venous and arterial thrombi and emboli with ^{131}I-labeled urokinase. The result of urokinase scintigraphy did not correspond to angiography in nine false negative cases out of 28. (auth)

9734 SIMPLE, RAPID ^{125}I RADIOIMMUNOASSAY FOR THE DETECTION OF BARBITURATES IN BIOLOGICAL FLUIDS. Cleeland, R.; Davis, R.; Heveran, J.; Grunberg, E. (Hoffman-LaRoche, Inc., Nutley, NJ). J. Forensic Sci.; 20: No. 1, 45-57 (Jan 1975).

A simple, rapid radioimmunoassay employing ^{125}I-labeled secobarbital derivative has been developed and has been shown to be capable of detecting at the nanogram level a variety of barbiturates in urine as well as in plasma. (auth)

9735 NUCLEAR LABELLING AFTER PROLONGED ^{3}H-URIDINE INCORPORATION AS VISUALIZED BY HIGH RESOLUTION AUTORADIOGRAPHY. Fakan, S.; Bernhard, W. (Inst. Suisse de Recherches Experimentales sur le Cancer, Lausanne, Switzerland). Exp. Cell Res.; 79: 431-444(Jun 1973).

Localization of radioactive labeling over the nuclei of BSC_1 cells is visualized after long periods of ^{3}H-5-uridine incubation followed or not followed by periods of postincubation in nonradioactive medium for up to several days, using high resolution autoradiography combined with a preferential staining method for ribonucleoproteins. It is shown that when cells are labeled for 1 or 6 h with ^{3}H-uridine and postincubated with a nonradioactive medium up to several days, there is always some radioactivity present in the nucleolus and nucleoplasm. When sections of cells fixed after 1 h of labeling followed by 24 h of postincubation are treated with RNase, part of the radioactivity found in the nucleus disappears almost completely only after a succeeding DNase digestion. The majority of interchromatin granules are weakly labeled after most incubation times, with the label localized rather at the periphery of clusters of granules, or are unlabeled. The results are discussed in the context of recent biochemical findings. It is proposed that

interchromatin granules might represent a structure containing a limited quantity of slowly labeled nuclear RNA. (auth)

9736 /sup 99m/Tc-POLYPHOSPHATE AND /sup 99m/Tc-DIPHOSPHONATE BONE SCINTIGRAPHY IN NEUROSURGICAL PRACTICE. Handa, J.; Yamamoto, I.; Morita, R.; Kousaka, T.; Fujita, T.; Handa, H. (Kyoto Univ. Medical School and Hospital). Surg. Neurol. (Tryon, N.C.); 2: 307-310(Sep 1974).

A report is presented of recent experiences with bone scintigraphy with /sup 99m/Tc-polyphosphate or /sup 99m/Tc-diphosphonate in 19 consecutive neurosurgical cases. Its value in clinical practice is discussed. (auth)

MATERIALS

9737 ADVANCES IN THERMAL CONDUCTIVITY. Presented at XIII International Conference on Thermal Conductivity, Lake Ozark, Missouri, November 5-7, 1973. Reisbig, R. L.; Sauer, H. J. Jr. (eds.). Rolla, MO; University of Missouri (1974). 467p. (CONF-731106-).

From 13th international conference on thermal conductivity; Lake Ozark, Missouri, USA (5 Nov 1973).

Thirty-four papers are presented under the following headings: solids, gases and liquids, heterogeneous materials, experimental techniques, analytical methods, and thermal diffusivity and contact conductance. Separate abstracts were prepared for four papers, 3 for NSA and one for ERA. Six of the remaining papers were previously abstracted; see NSA 29: 12987, 26535, 28926, 29245; 30: 2366; and 31: 11992. (DLC)

For abstracts of individual papers see: 9747, 9892, and 9893.

9738 MATERIALS REVIEW '75. 7th National SAMPE Technical Conference, Albuquerque, New Mexico, October 14-16 1975. Volume 7. Azusa, CA; Society for the Advancement of Material and Process Engineering (1975). 345p. (CONF-751005-).

From 7th national SAMPE technical conference; Albuquerque, New Mexico, USA (14 Oct 1975).

This volume and the supplement contain 45 papers on bonding, composites, adhesives, energy developments, filament winding, aging of adhesives, surface physics and chemistry, new materials, mechanical properties, heat-shrinkable materials, and sun power. Separate abstracts were prepared for 18 of the papers; 17 items are included in ERA; 2 in NSA; and 4 in SEU. (DLC)

For abstracts of individual chapters see: 8858 and 9894.

Ceramics and Cermets

Refer also to abstracts 8870, 8981, 8984, 9777, 9850, 9893, 11227, and 11231.

9739 (FRNC-TH-560) PREPARATION OF HAFNIUM CARBIDE BY CHEMICAL VAPOR DEPOSITION. Hertz, D. (Grenoble-1 Univ., 38 (France)). 1974. 126p. (In French). INIS.

Thesis.

Hard, adhesive coatings of single-phase hafnium carbide were obtained by chemical vapor reaction in an atmosphere containing hafnium tetrachloride, methane, and a large excess of hydrogen. By varying the gas phase composition and temperature the zones of formation of the different solid phases were studied and the growth of elementary hafnium and carbon deposits evaluated separately. The results show that the mechanism of hafnium carbide deposition does not involve phenomenon of homogeneous-phase methane decomposition or tetrachloride reduction by hydrogen unless the atmosphere is very rich or very poor in methane with respect to tetrachloride. However, hydrogen acting inversely on these two reactions, affects the stoichiometry of the substance deposited. The methane decomposition reaction is fairly slow; the reaction leading to hafnium carbide deposition is faster, and that of tetrachloride reduction by hydrogen is quite fast. (FR)

9740 (UCRL-Trans-10951) CRYSTAL STRUCTURE OF BeB_3. Mattes, R.; Tebbe, K. F.; Neidhard, H.; Rethfeld, H. Translated from Z. Anorg. Allg. Chem.; 413: No. 1, 1-9(1975). 15p. Dep. NTIS $4.50.

The crystal structure of the boride $Al_{0.05}BeB_{3.05}$ was determined by three-dimensional x-ray analysis. The unit cell dimensions are: a equals 9.800(1) A, c equals 9.532(1) A; I equals 26.6; space group: P6/mmm; density 2.43 g/cm^{-3}. The complex structure contains B_{12} icosahedra and other polyhedral units occupied by boron and beryllium atoms. The linkage between the polyhedra is related to the linkage of B_{12} icosahedra in beta-rhombohedral boron. The aluminium atoms occupy interstitial sites. (auth)

9741 EXAMINATION OF THE TOTAL PRESSURE OVER HYPOSTOICHIOMETRIC URANIUM DIOXIDE. Winslow, G. H. (Argonne National Lab., IL). High Temp. Sci.; 7: No. 2, 81-102 (Jun 1975).

The standard free energy of formation of stoichiometric UO_2 is reevaluated. An altered valent cation model, descriptive of the oxygen potential throughout the hypostoichiometric domain of urania, is integrated analytically so that activities of (U) and of (UO_2) and the free energies of formation of [UO/sub 2-x/] can be evaluated. By including separately determined values for the vapor pressure of uranium and the free energy of formation of (UO_3) and by imposing the independence of composition of DELTA G^0/sub integral/(UO) as a condition, the latter and $p^0(UO_2)$ are determined from observations of the total pressure of uranium bearing species. This resolution of the total pressure of uranium-bearing species plus the starting equations for the oxygen potential enable determination of the congruently vaporizing compositions, which are found to be much nearer stoichiometry than are experimental results. By including separately determined mass spectrometric observations of (I$^+$T) at the lower phase boundary, evaluations are made of the instrument sensitivities for the various species in the gas phase. While the model well describes the observations of oxygen potential, it leads to obviously erroneous contributions to the enthalpy of stoichiometric uranium dioxide. 11 figures, 60 references. (auth)

9742 ATOM VACANCIES AND THEIR EFFECTS ON THE PROPERTIES OF NbN CONTAINING CARBON, OXYGEN, OR BORON. I. Phase Boundary, Thermodynamics, and Lattice Parameter. Storms, E. K. (Los Alamos Scientific Lab., NM). High Temp. Sci.; 7: No. 2, 103-121(Jun 1975).

The NbC-NbN and NbN-NbO systems were studied by density and lattice parameter measurements to determine the concentration of atom vacancies in the metal and nonmetal sublattices of the cubic (B1) structure as a function of pressure, temperature, and composition. Equations are given which define the thermodynamic behavior. Metal vacancies which occur near the nitrogen rich end of the NbN-NbC system and throughout the NbN-NbO system have a marked effect on the lattice parameter. The behavior of the lattice parameter can be explained if the niobium atoms increase in size in proportion to the number of electrons transferred from the nonmetal sublattice. The phase boundary of the cubic phase at 1643°K and 1.0 is $Nb_{0.98}N_{0.92}$. Dissolved oxygen and to a less extent carbon cause the atom ratio at this boundary to increase. Equations are given which allow the boundary to be calculated at other temperatures and pressures. 13 figures. (auth)

9743 VAPORIZATION OF CADMIUM OXIDE BY KNUDSEN EFFUSION. Miller, A. R. (New Mexico Inst. of Mining and Tech., Socorro). High Temp. Sci.; 7: No. 2, 126-130(Jun 1975).

The vaporization of CdO in alumina by Knudsen effusion cells was investigated over the temperature range 1014-1188°K. The equilibrium constant for the reaction CdO(s) equals Cd(g) + ½ O_2(g) was found to be log K equals 10.68 - 19,084/T, and the second-law DELTA H^0_{298} for this reaction calculated by the sigma method was found to be 89.2 +- 3.0 kcal, closely agreeing with the mean third-law DELTA H^0_{298} of 88.9 + 1.0 kcal. It was determined that the vaporization of CdO is congruent with a sublimation coefficient close to unity. (auth)

9744 KNUDSEN CELL VAPORIZATION OF RARE EARTH NITRIDES: ENTHALPY OF VAPORIZATION OF HoN/sub 0.98/. Brown, R. C.; Clark, N. J. (Flinders Univ. of South Australia, Bedford Park). High Temp. Sci.; 7: No. 2, 131-141(Jun 1975).

The enthalpy of vaporization of $HoN_{0.98}$ was measured by the weight-loss Knudsen cell technique using Motzfeldt-Whitman extrapolations to zero orifice area. A third-law enthalpy of vaporization of $HoN_{0.98}$ of 155.9 +- 5 kcal mole^{-1} was obtained compared to a second-law value of 162.0 +- 5 kcal mole^{-1}. Similar measurements on the nitrides of samarium, erbium, and ytterbium gave third-law enthalpies of vaporization of 126.8 +- 5 kcal mole^{-1}; 159.6 +- 5 kcal mole^{-1}, and 121.0 +- 5 kcal mole^{-1}, respectively. 7 tables. (auth)

9745 PHASE EQUILIBRIA AND CRYSTAL GROWTH OF ALKALINE EARTH AND LANTHANIDE DIHYDRIDES. Haschke, J. M.; Clark, M. R. (Univ. of Michigan, Ann Arbor). High Temp. Sci.; 7: No. 2, 152-158(Jun 1975).

The vaporization reactions of the dihydrides of Mg, Ca, Ba, Sm, and Eu have been investigated by effusion methods and x-ray diffraction procedures. Unlike YbH_2, these dihydrides vaporize incongruently to form gaseous hydrogen and the condensed metals. Single crystals of YbH_2 were prepared by a vapor transport technique and characterized by x-ray methods. Twinned crystals were observed, and a twinning mechanism is described. The single crystal results and high temperature powder diffraction data indicate that orthorhombic ($PbCl_2$ type) YbH_2 is stable up to 825°C. The anomalous vaporization mode of YbH_2 and the previously reported orthorhombic to fcc thermal transitions of this dihydride are discussed. (auth)

9746 ELASTIC PROPERTIES OF NONSTOICHIOMETRIC NIOBIUM CARBIDES IN THE RANGE 20 TO 2000°C. Baranov, V. M.; Knyazev, V. I.; Korostin, O. S. (Moscow Inst. of Engineering Physics). Inorg. Mater. (USSR) (Engl. Transl.); 11: No. 3, 375-378(Mar 1975).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 11: No. 3, 442-446(Mar 1975).

Elastic moduli of niobium carbides were measured in a wide range of compositions and temperatures. A nonlinear composition dependence of the elastic moduli in the nonporous state, the Debye temperature, and the Grueneisen constant was found in the range $0.77 \leq C/Nb \leq 0.86$. The introduction of an exponential term is proposed, which takes account of the nonlinear decrease in the elastic modulus at elevated temperatures, into the Wachtman equation. They establish the applicability of the Anderson equation (verified for refractory oxides) to niobium carbide. (auth)

9747 TRANSPORT PROPERTIES OF TRANSITION METAL CARBIDE. Wu, K. Y.; Taylor, R. E. (Purdue Univ., West Lafayette, IN). pp 57-73 of Advances in Thermal Conductivity. Reisbig, R. L. (ed.). Rolla, MO; Univ. of Missouri (1974).

From 13th international conference on thermal conductivity; Lake Ozark, Missouri, USA (5 Nov 1973). See CONF-731106-.

The purpose of this study was to study the scattering mechanisms of heat carriers in TiC. Measurements of electric resistivity, thermopower, Lorentz function, and lattice thermal conductivity were carried out on pure TiC and TiC–2.4 and 25 mole percent VC. 8 figures (DLC)

9748 DECOMPOSITION THERMODYNAMICS OF FLUORITE-LIKE SOLID SOLUTIONS IN SYSTEMS BASED ON ZIRCONIUM DIOXIDE. Sukharevskii, B. Y.; Gavrish, A. M.; Zoz, E. I. (Physicotechnical Inst. of Low Temperatures, Kiev). Inorg. Mater. (USSR) (Engl. Transl.); 11: No. 3, 393-397(Mar 1975).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 11: No. 3, 465-470(Mar 1975).

Calculations agree well with the experimental data obtained from an investigation of the decomposition of cubic solid solutions of the fluorite type in the systems $ZrO_2-CaO(MgO, Y_2O_3)$ and permit an explanation of the variation of the rate of decomposition with temperature and the concentration and type of the second component. (auth)

9749 EFFECT OF ADDITION OF SMALL AMOUNTS OF GeO_2, Yb_2O_3, AND B_2O_3 ON THE REACTION OF ZrO_2 WITH Ln_2O_3. Krzhizhanovskaya, V. A.; Glushkova, V. B.; Keler, E. K.; Shcherbakova, L. G. (Inst. of Silicate Chemistry, Moscow). Inorg. Mater. (USSR) (Engl. Transl.); 11: No. 3, 398-401(Mar 1975).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 11: No. 3, 471-474(Mar 1975).

Addition of GeO_2, Yb_2O_3, and B_2O_3 to the extent of 2-3 mole % to ZrO_2 improves the sintering of tablets of the latter. The preferential diffusion of Ln_2O_3 in ZrO_2, $[ZrO_2 + Yb_2O_3]$, and $[ZrO_2 + B_2O_3]$ was established. The diffusion coefficients of the rare earths have been determined. The dependence of diffusion on the heats of formation of the end products, the ionic radii, and the presence of a liquid phase in the systems $Ln_2O_3-ZrO_2-B_2O_3$ was investigated. (auth)

9750 PRIMARY CRYSTALLIZATION REGIONS IN THE SYSTEM $Gd_2O_3-Fe_2O_3-PbO-B_2O_3$. Sapozhnikov, Yu. L.; Titova, A. G. Inorg. Mater. (USSR) (Engl. Transl.); 11: No. 3, 402-405(Mar 1975).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 11: No. 3, 475-478(Mar 1975).

Regions of preferential crystallization of garnet, orthoferrite, and magnetoplumbite were distinguished. The main factor governing the primary phase is the ratio $Gd_2O_3:Fe_2O_3$; with an increase in the Fe_2O_3 content, the garnet region becomes larger and the orthoferrite region smaller. (auth)

9751 THERMAL EXPANSION OF CUBIC SOLID SOLUTIONS IN THE SYSTEM ZrO_2-HfO_2-CaO. Zoz, E. I.; Gavrish, A. M.; Solov'eva, A. E. (Ukrainian Scientific-Research Inst. of Refractories, Kiev). Inorg. Mater. (USSR) (Engl. Transl.); 11: No. 3, 478-479(Mar 1975).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 11: No. 3, 559-560(Mar 1975).

Cubic solid solutions of the fluorite type were synthesisized containing 10 to 20 mole % CaO and 8 to 90 mole % HfO_2. Axial and bulk thermal expansion coefficients were measured over the range 30 to 1450°C. The unit cell constants and volumes increase linearly with temperature. The thermal expansion coefficient decreases with HfO_2 and CaO contents, the decrease being greater for HfO_2. (DLC)

9752 ELECTRICAL CONDUCTIVITY OF PARTIALLY REDUCED NIOBIUM PENTOXIDE. Vovkotrub, E. G.; Rozanov, I. G.; Kasimov, G. G. (Ural Polytechnical Inst., USSR). Inorg. Mater. (USSR) (Engl. Transl.); 11: No. 3, 480-481(Mar 1975).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 11: No. 3, 561-562(Mar 1975).

The electric conductivity of partly reduced Nb_2O_5 at room temperature is five orders of magnitude higher than that of NbO_2, but this difference disappears at high temperatures (~ 1000°K). The composition of specimens reduced for 4, 8, and 12 h is $NbO_{2.4}$, $NbO_{2.3}$, and $NbO_{2.2}$, respectively. (DLC)

9753 PRINCIPLES GOVERNING SOLID PHASE REACTIONS OF HIGH MELTING COMPOUNDS WITH TRANSITION METALS AND GRAPHITE. Samsonov, H. V.; Burykina, A. L.; Evtushok, T. M.; Evtushenko, O. V. Visn. Akad. Nauk Ukr. RSR; No. 11, 19-28(1974). (In Russian)

The thermodynamics and kinetics of solid phase reactions are discussed since they determine the stability of a system and the likely occurrence of a reaction under given conditions of temperature, pressure, and physical factors of the reactants. The topics covered included the mechanism of action of solid phase reactions, as well as examples of experimental studies on reactions of carbides with metals, borides with metals, nitrides with metals, carbides with graphite, borides with graphite, nitrides with graphite and silicides with graphite. Factors affecting such interactions are also considered. Refs 26. (JPRS)

9754 PROPERTIES OF TITANIUM CARBIDE-COATED CEMENTED TUNGSTEN CARBIDES. Lee, M.; Richman, M. H. Met. Technol.; 1: No. 12, 538-546(Dec 1974).

Results of investigations into the behaviour of TiC-coated cemented-carbide cutting tools under conditions of abrasive, adhesive, oxidation, and diffusion wear are reported. The coated tools had excellent resistance to these wear conditions. The hardness and transverse (bend) rupture strength of the coating in relation to its microstructure were investigated. The elongated grains of the coating were oriented normal to the substrate surface and were responsible for the relatively low transverse rupture strength of the coated tools. The coating had cracked readily under thermal shock because of the mismatch in the coefficient of thermal expansion of the coating and the substrate. Examination of diffusion couples suggests that a thin η-carbide layer, which develops just beneath the coating during production, is partially responsible for the good performances of coated tools even after portions of the coating have failed. (Metals Abstr.)

9755 EROSION RESISTANCE OF THE CARBONITRIDES OF GROUP IV AND V TRANSITION METALS. Bilyk, I. I.; Verkhoturov, A. D. Elektron. Obrab. Mater.; 6: 18-21(1974). (In Russian)

The erosion resistance of the carbonitrides (usually nonstoichiometric) of Group IV and V transition metals (Ti, Zr, V, and Nb) was studied in relation to their composition and in particular to their stable electron configurations. The erosion resistance of the carbonitrides was substantially affected by their hardness, coefficient of thermal expansion, and electrical resistance. A close correlation existed between erosion resistance and the electron structure of these materials. There was a sharp reduction in the erosion of carbides with the greatest degree of localization of the valence electrons of C in the stable sp^3 configurations of TiC and ZrC. On adding N to the carbides erosion fell as a result of the elimination of local brittle fracture. (Metal Abstr.)

9756 KINETICS OF THE ANODIC DISSOLUTION OF THE TUNGSTEN CARBIDE: COBALT ALLOY VK-8 BY ELECTROCHEMICAL GRINDING. Grodzinskii, E. Ya.; Kozlov, M. V.; Davydov, A. D. Elektron. Obrab. Mater.; No. 6, 82-84(1974). (In Russian)

A method of measuring polarization curves, under conditions of electrochemical grinding, is described, together with an example of its use in the processing of the WC–Co alloy VK-8. The electrolyte comprises a mixture of $NaNO_2$ and $NaNO_3$. Analysis of the polarization curves confirms that for each particular current density, there is a certain feed rate of the abrasive wheel for which complete depassivation of the anode surface occurs. Under these conditions the rate of material removal by mechanical action considerably exceeds the electrochemical contribution. The surface of the hard alloy remains in a partly overpassivated state for all practically feasible rates of feed. Hence a 100% current efficiency can never be achieved. (Metals Abstr.)

9757 PHYSICAL PROPERTIES OF BORON CARBIDE ALLOYS WITH VANADIUM AND CHROMIUM ADDITIVES. Marek, E. V.; Dudnik, E. M.; Makarenko, G. N.; Remenyuk, E. A. (Inst. of Problems of Material Sciences, Kiev). Porosh. Metall., Akad. Nauk Ukr. SSR; No. 2, 54-56(Feb 1975). (In Russian)

A study was made of the macrohardness, the coefficient of thermal expansion and the electrical resistance of BC alloys of technical purity with 0.3, 0.5, 3.0, and 5.0 percent by weight chromium and vanadium additives. With an increase in the alloying additive content the coefficient of thermal expansion decreases and the macrohardness increases. The studies of the temperature dependence of the electrical resistance demonstrated that all of the alloys have a semiconducting nature. (JPRS)

9758 TERNARY SYSTEM NICKEL–NIOBIUM–CARBON. Stadelmaier, H. H.; Fiedler, M. L. (North Carolina State Univ., Raleigh (USA). Dept. of Engineering Research). Z. Metallkd.; 66: No. 4, 224-225(Apr 1975).

The ternary system nickel–niobium–carbon was studied by metallographic and x-ray diffraction methods to produce a liquidus projection and an isothermal section at 1,100°C. The liquidus projection is dominated by a wide field of primary NbC that extends far into the nickel corner of the composition triangle. Only one ternary compound is observed in this system, an eta-carbide formed in a peritectoid reaction. It has a narrow homogeneity range at Ni_2Nb_4C, and its lattice constant in alloys quenched from 1,100°C varies between 11.659 and 11.667 Å. No eta-carbide Ni_3Nb_3C or Ni_6Nb_6 could be detected. (auth)

9759 ACOUSTIC MODES OF THE PHONON DISPERSION RELATION OF NbD/sub x/ ALLOYS. Rowe, J. M. (National Bureau of Standards, Washington, DC); Vagelatos, N.; Rush, J. J.; Flotow, H. E. Phys. Rev., B; 12: No. 8, 2959-2964(15 Oct 1975).

The acoustic modes of the phonon dispersion relation in Nb, $NbD_{0.15}$, and $NbD_{0.45}$ were measured at 473°K for phonons with wave vectors along the [100], [110], and [111] axes by coherent neutron scattering. The observed neutron groups for both alloys were well defined, with little or no apparent broadening. Results are compared to similar data for Nb–Mo alloys and with previous lattice-dynamics results for $PdD_{0.63}$. This comparison shows that despite differences in detail, the general features of the dispersion relations of NbD/sub x/ and Nb–Mo are similar after allowing for the differences in lattice parameters for the two alloys. The measured dispersion curves and derived phonon frequency distributions for the Nb–D alloys are quite different from the analogous results for $PdD_{0.63}$ in that the average acoustic phonon frequencies increase with increasing deuterium concentration and lattice parameter. (auth)

9760 MECHANISM OF ELECTROCHROMISM IN WO_3. Hersh, H.N.; Kramer, W.E.; McGee, J.H. (Zenith Radio Corporation Research Laboratories, Chicago, Illinois 60639). Appl. Phys. Lett. 27: No. 12, 646-648 (15 Dec 1975).

X-ray photoelectron spectra of colored WO_3 films, thermodynamic analysis of galvanic behavior of the tungstic oxide cathode, plus other new lines of evidence, clearly establish the previously uncertain mechanism of the electro-optic effect in amorphous WO_3, viz., a simultaneous injection of electrons and positive ions into a film via an electrochemical process, with the consequent development of a low-x tungsten bronze. The positive ion, in both the films and in tungsten bronzes, remains fully ionized even in the presence of high densities of injected electrons. (auth)

9761 YIELD STRESS OF CEMENTED TUNGSTEN CARBIDE. Ruoff, A.L.; Wanagel, J. (Department of Materials Science and Engineering, Cornell University, Ithaca, New York 14853). J. Appl. Phys. 46: No. 11, 4647-4648 (Nov 1975).

Cemented tungsten carbide yields plastically at room temperature in the presence of a large hydrostatic pressure component. By approximate analysis of the state of stress in supported opposed anvils and by measurement of the pressure at which the anvil tips exhibit a permanent deviation from planarity, we have obtained the yield stress of such materials. Our value for the yield stress of a 3% cobalt cemented tungsten carbide is 86 kbar. (auth)

9762 INFLUENCE OF DISSOLVED NITROGEN AND CARBON ON REACTIONS OF CERIUM (III) AND CERIUM (IV) OXIDES WITH LIQUID LITHIUM. Barker, M. G.; Alexander, I. C. (Univ. of Nottingham, Eng.). J. Chem. Soc. (London), Dalton Trans.; No. 14, 1464-1466(1975).

Cerium (IV) oxide, CeO_2, reacts with pure liquid lithium at 360°C to give the previously unreported ternary oxide $LiCeO_2$. The latter is not stable towards nitrogen dissolved in the liquid metal. Reaction of both CeO_2 and cerium (III) oxide, Ce_2O_3, with liquid lithium containing dissolved nitrogen gives lithium oxide and cerium mononitride, CeN, as products. At higher nitrogen concentrations the formation of the ternary nitride Li_2CeN_2 has been observed. Reaction of CeO_2 with liquid lithium containing dissolved carbon gives Li_2O and the carbide CeC as products. Cerium (III) oxide does not react with pure liquid lithium. (auth)

9763 METHOD OF FORMING HIGH DENSITY OXIDE PELLETS BY HOT PRESSING AT 50° TO 100°C ABOVE THE CUBIC TO MONOCLINIC PHASE TRANSFORMATION TEMPERATURE. Pasto, A. E. (to U. S. Energy Research and Development Administration). US Patent 3,898,309. G21C21/00. 5 Aug 1975. Filed Date 11 May 1973. 4p.

PAT-APPL-359,397.

A process for low temperature sintering of rare earth and actinide oxides which have a cubic to monoclinic transformation is described. The process involves hot pressing a powder compact at a temperature just above the transformation temperature. (auth)

9764 THERMODYNAMIC STUDY OF NONSTOICHIOMETRIC CERIUM DIOXIDE. Panlener, R. J.; Blumenthal, R. N.; Garnier, J. E. (Marquette Univ., Milwaukee). J. Phys. Chem. Solids; 36: No. 11, 1213-1222(Nov 1975).

Thermogravimetric measurements were performed on nonstoichiometric CeO_{2-x} in the temperature range 750 to 1500°C and from oxygen pressures of 10^{-2} to 10^{-26} atm. From these data the deviation from stoichiometry $x = x(T, P_{O_2})$ was determined. The thermodynamic quantities $\Delta \bar{H}_{O_2}$ and $\Delta \bar{S}_{O_2}$ were calculated in the region $0.001 \leq x \leq 0.3$ and found to be independent of temperature. In the composition region $0.001 < x < 0.006$, the variation of $\Delta \bar{S}_{O_2}$ with x is consistent with a defect model involving randomly distributed doubly ionized oxygen vacancies. The experimental $P_{O_2}^{1/4}$ dependence of x and σ (electrical conductivity) is shown to be consistent with this model as $\Delta \bar{H}_{O_2}$ (≈−10 eV) exhibits a slight dependence on x. It is postulated that the variation in $\Delta \bar{H}_{O_2}$ may result from lattice parameter increases with x, while the defects remain essentially randomly distributed. In the composition region $0.006 < x < 0.1$, $x \propto P_{O_2}^{1/n}$ with $1 < n < 5$, and in the region $0.1 < x < 0.3$, $x \propto P_{O_2}^{1/n}$ with n increasing rapidly with x to $n \approx 30$. This behavior is believed to result from increasing defect interaction with increasing departures from stoichiometry. It is interesting to note that the ordered phases observed by Bevan and Kordis between $CeO_{1.72}$ and $CeO_{1.70}$ was not observed in this study at temperatures between 1300 and 1500°C. (auth)

9765 PHASE TRANSITIONS AND DIFFUSION OF HYDROGEN IN METALS. Alefeld, G. (Technische Univ., Munich). Comments Solid State Phys.; 6: No. 3/4, 53-62(Sep 1975).

A review is given of the basic properties of hydrogen-metal systems, with particular emphasis on phase transitions and diffusion phenomena. Practical applications are also discussed. 48 references. (UK)

9766 DIRECT LATTICE IMAGING OF SILICON CARBIDE. Gai, P. L.; Anderson, J. S.; Rao, C. N. R. (Oxford Univ.). J. Phys., D (London); 8: No. 13, L157-L158(11 Sep 1975).

The high-resolution electron microscopic technique of lattice imaging shows 15 and 3 Å repeat sequences in 6H SiC. The 15 Å sequence is further resolved into 2.5 layers corresponding to the interlayer separation. (auth)

9767 INELASTIC LIGHT SCATTERING IN THE Eu CHALCOGENIDES AND IN YbTe. Vitins, J.; Wachter, P. (Eidgenoessische Technische Hoschule, Zurich). Solid State Commun.; 17: No. 5, 911-914(1 Oct 1975).

First-order inelastic light scattering exhibiting broad linewidths and multi-phonon lines was measured in the magnetically ordering EuO, EuSe, and EuTe as well as in the diamagnetic YbTe. Whereas the light scattering of EuSe is similar to that of the earlier investigated EuS, it is found that EuO, EuTe, and YbTe exhibit in part an anomalous behavior. It is concluded that the inelastic broad-line light scattering found in these compounds cannot be explained by Raman theory. Instead, it is suggested that this light scattering is better characterized by a recombination process. (auth)

9768 ELECTRICAL AND MAGNETIC PROPERTIES OF $Er_2(WO_4)_3$. Lal, H. B.; Naseeb-Dar; Kumar, A. (Gorakhpur Univ., India). J. Phys., C (London); 8: No. 17, 2745-2748(7 Sep 1975).

Measurements of the electrical conductivity, dielectric constant, and magnetic susceptibility of pellets of erbium tungstate are reported for the temperature range 300 to 1000°K. The known phase transition near 600°K is in evidence in all these measurements. The conductivity data for T > 600°K were analyzed in terms of an exponential relation $\sigma = \sigma_O \exp(-E_g/2kT)$, giving $\sigma_O = 8.892 \times 10^2$ ohm^{-1} cm^{-1} and $E_g = 1.52$ eV. There is a weak dispersion in the dielectric constant at around 10^4Hz and a rapid increase above 600°K. The high-temperature data for the susceptibility obey a Curie–Weiss law that gives a value of 9.50 Bohr magneton for Er^{3+} ions and a (ferromagnetic) Curie temperature of 160°K. (auth)

Metals and Alloys

Refer also to abstract 11384.

9769 (AGC-2275(Add.)) MATERIALS PROPERTIES DATA BOOK. NERVA Program. (Aerojet-General Corp., Sacramento, Calif. (USA)). 15 Nov 1970. 46p. Dep. NTIS $5.50.

Data are presented on Nerva Reactor materials including alloy 718 347 stainless steel, Al-base alloys, Ti-base alloys, alloy A-286, stainless steel 440C, Rockide A, brass, Be-base alloys, Invar 36, and SI steel. (JRD)

9770 (ORNL-5048) HIGH-TEMPERATURE STRUCTURAL DESIGN PROGRAM. Progress Report for Period Ending Decem-

ber 31, 1974. Corum, J. M.; Pugh, C. E. (Oak Ridge National Lab., Tenn. (USA)). Oct. 1975. Contract W-7405-eng-26. 344p. AT.

Activities are reported concerning exploratory studies on reactor steels; constitutive equation development; materials failure; structural analysis methods and tools; inelastic structural testing and design criteria. (JRD)

9771 HISTORICAL DEVELOPMENT OF ALLOY 800: AN OVERVIEW. Cordovi, M. A. (International Nickel Co. of Canada Ltd., Toronto). pp 1-14 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

Alloy 800 was developed in 1949 by The International Nickel Company, Inc. The basic composition, nominally 32% Ni, 20.5% Cr, and 46% Fe, was designed to provide a stable, fully austenitic structure and to impart high strength combined with resistance to oxidation, carburization, and corrosion in a wide variety of aggressive industrial environments at elevated temperatures. In the short span of twenty-five years, alloy 800 has earned a unique position in the family of heat- and corrosion-resistant materials. Established uses include a wide range of applications in the industrial heating field, in the petrochemical industry, in domestic appliances and in food processing equipment. The good performance of alloy 800 in these applications has led to its use as boiler tube material both in fossil-fired plants and in HTGR and PWR nuclear power systems. Recently, it was specified for a PHW CANDU reactor and it is now being considered as heat exchanger tube material for the LMFBR and for coal gasification reactor vessel internals. (auth)

9772 BNES MATERIALS CONFERENCE: A STATUS REVIEW OF ALLOY 800. Editor's Introduction and Summary of the Proceedings. Pugh, S. F. (United Kingdom Atomic Energy Authority, Harwell, Eng.). pp 4-18 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

Existing applications of alloy 800 are summarized, with particular reference to its use in various reactor types. The need for a coordinated research and development program is stressed, and the variables to be explored are outlined. The papers relating to the problem of corrosion and cracking in water and steam are considered. The strength and ductility of alloy 800 is considered. Finally, sections of the summary deal with the use of alloy 800 for (a) sodium cooled fast reactor boiler tubes; (b) the HTGR; and (c) PWR steam generator tubes. (UK)

9773 ELEVATED TEMPERATURE PROPERTIES FOR ISO STANDARDS. Guest, J. C. pp 251-263 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

A 30% Nickel 20% Chromium alloy containing titanium and aluminium is included in the Draft International Standard 2604 prepared by ISO/TC17/SC10, Steels for Boilers and Pressure Vessels. The composition adopted which was that widely specified in U.S., U.K. and German standards and designated P69 for plates, or TS69 for tubes, was as follows: carbon 0.10% max, chromium 19.0 to 23.0%, nickel 30.0 to 35.0%, aluminium 0.15 to 0.60%, titanium 0.15 to 0.60%, with requirements for Si, Mn, S, P, and Cu. The elevated-temperature properties sub group of SC10 had the task of assessing relevant property data from International sources in line with the requirements of the design codes being prepared by ISO TC11. The latter called for minimum values of proof stress and average values for stress rupture properties. Data were collected and assessed in 1971 and the values approved in 1972. (auth)

Corrosion and Erosion

Refer also to abstract 10612.

9774 (AECL-5227) MATERIALS RESEARCH IN AECL. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sum 1975. 23p. Dep. NTIS (US Sales Only) $4.50. AECL $1.00.

Research is being done on activity transport (radioactivation of corrosion products and their transport in reactor systems): surface chemistry of metals and their oxides in hot water (Cu oxidation, DP33 surface); mathematical models for ^{60}Co deposition; materials selection for Pickering, Bruce, Gentilly, and future reactors; hot filter development (edge, graphite, and magnetic); and decontamination (Douglas Point, Can-Decan). (DLC)

9775 (AGARD-AG-200) HIGH TEMPERATURE CORROSION OF AEROSPACE ALLOYS. Stringer, J. F. (Advisory Group for Aerospace Research and Development, 92- Neuilly-sur-Seine (France)). 1975. 610p.

This is the work of the Structures and Materials panel of the Advisory Group for Aerospace Research and Development (AGARD). The data on high-temperature oxidation and corrosion are arranged into three parts: basic data, oxidation and hot corrosion of commercial superalloys, and refractory metals. (DLC)

9776 (ICP-1071) CORROSION MONITORING OF STORAGE BINS FOR RADIOACTIVE CALCINES. Hoffman, T. L. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs - Operations Office). Oct 1975. Contract E(10-1)-1375. 18p. Dep. NTIS $4.00.

Highly radioactive liquid waste produced at the Idaho Chemical Processing Plant is calcined to a granular solid for long-term storage in stainless steel bins. Corrosion evaluation of coupons withdrawn from these bins indicates excellent performance for the materials of construction of the bins. At exposure periods of up to six years the average penetration rates are 0.01 and 0.05 mils per year for Types 304 and 405 stainless steels, respectively. (auth)

9777 SELECTION AND PERFORMANCE OF HARD-FACING ALLOYS. Farmer, H. N. (Stoody Co., Whittier, CA). Met. Eng. Q.; 15: No. 4, 9-15(Nov 1975).

From symposium on materials for the mining industry; Vail, CO (30 Jul 1974).

The many hard-facing alloy combinations are divided into 5 broad categories related to their suitability for different types of wear and service conditions: buildup of steel machinery parts and of austenitic Mn steel parts, hard-facing machinery steels, high alloys for highly abrasive conditions, tungsten carbide for extreme abrasion and cutting, and nonferrous for abrasion accompanied by high temperature and/or corrosion. Choice of the facing material is discussed. (DLC)

9778 CORROSION OF MOLYBDENUM ALLOYS IN CURRENTS OF INERT GASES [OF COMMERCIAL PURITY]. Dushin, Yu. A.; Solomko, Yu. V.; Petrovskaya, I. D. pp 28-33 of Vliyanie Fiz.-Khim. Sredy na Zharoprochnost Metal. Materialov. Moscow; Izdatel'stvo Nauka (1974). (In Russian)

Mechanical properties and structure of refractory metals were determined after exposure to inert gases in high-temperature equipment. Corrosion rates were determined by the impurity levels in these gases, and by their rate of flow. For the Mo-base alloy containing Zr 0.07 and C 0.02%, the degree of corrosion was assessed after successive exposures to Ar containing oxidizing, and then reducing, impurities. These experimental data were combined with the thermodynamic calculations for the Mo–Zr (Ti)–O–N–C–H system to predict the period of useful life of these alloys in gas-dynamic conditions. (Metals Abstr.)

9779 EFFECT OF THE COMPONENTS OF AIR ON THE OXIDATION RESISTANCE OF REFRACTORY GROUP VIA METALS. Larikov, L. N.; Tyshkevich, V. M. pp 21-27 of Vliyanie Fiz.-Khim. Sredy na Zharoprochnost Metal. Materialov. Moscow; Izdatel'stvo Nauka (1974). (In Russian)

Thermogravimetric analysis was used to study the mechanism and kinetics of the reactions between the Group VIA metals Mo, W, and Cr and the gases present in air. Oxidation of Mo obeys different laws depending on the temperature range, and similarly the oxidation rates of single crystals of this metal and of W differ for different crystallographic faces. Additional studies were made of the effects of alloying with Y on the reactions of Cr with O and N, and of the reaction rates of various Mo and W alloys with O. Effects of plastic deformation on these processes are discussed. (Metals Abstr.)

9780 CHEMISORPTION BOND LENGTH AND BINDING LOCATION OF OXYGEN IN A $p(2 \times 1)$ OVERLAYER ON W(110) USING A CONVERGENT, PERTURBATIVE, LOW-ENERGY-ELECTRON-DIFFRACTION CALCULATION. Van Hove, M.A.; Tong, S.Y. (Department of Physics and Surface Studies Laboratory, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin 53201). Phys. Rev. Lett. 35: No. 16, 1092-1095 (20 Oct 1975).

A convergent perturbation scheme known as the layer-doubling method is used to determine the chemisorption position and bond length of an oxygen $p(2 \times 1)$ overlayer on W(110) surface. The use of perturbation treatment allows accurate and economical determination of surface crystallography on this strong-scattering material. Using eight phase shifts and 89 beams in the calculation, the oxygen atoms are found to occupy threefold-coordinated binding sites with a bond length of 2.08 Å. (auth)

9781 CORROSION AND STRESS CORROSION CRACKING OF ALLOY 800 IN WATER AND STEAM AT ELEVATED TEMPERATURES. Blanchet, J.; Goriou, G.; Grall, L.; Yvet, R.

(CEN, Fontenay-aux-Roses, France). pp 64-77 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

The importance that must be attached to the phenomenon of stress corrosion cracking of austenitic alloys is emphasized. The relation between chemical composition of various alloys and their sensitivity to cracking is shown with particular reference to the behavior of alloy 800. Different effects of alkaline and chloride environments are discussed. Studies are reported of the general corrosion of alloy 800 and other alloys in an environment representative of the primary coolant of PWR reactors, and of the behavior of various alloys (including alloy 800) in the conditions envisaged for their use for steam generators with superheat up to about 550°C. (UK)

9782 STRESS CORROSION CRACKING OF ESSHETE 800L IN PRESSURIZED WATER ENVIRONMENTS. Hooper, R. A. E. (British Steel Corp., Port Talbort, Eng.); Hutchings, J. A. pp 78-84 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

Stress corrosion tests were carried out on samples of Esshete 800L in a high temperature pressurized water environment. The alloy was produced by the Special Steels Division of the British Steel Corporation and seamless tubing was fabricated by Tube Investments Ltd. Cold work, sensitization, and low titanium/carbon + nitrogen ratio were all shown to reduce the resistance of Esshete 800L to stress-assisted intergranular cracking. However, determination of failure rates in experimental batches of material exposed to unusually aggressive environments cannot be simply used to estimate the life of optimized materials under normal service conditions. (auth)

9783 RESISTANCE OF ALLOY 800 TO CHLORIDE STRESS CORROSION CRACKING. Weldon, B. A. (International Nickel Co., Inc., New York). pp 87-90 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

One of the contaminants most likely to occur in boiler waters is chloride and this could arise, for instance, from a condenser tube failure especially in a coastal plant. Some comments are made on the resistance of alloy 800 to chloride stress corrosion cracking with reference to other environmental factors and in relation to other candidate alloys for boiler tubes. The effects of chloride concentration, pH, temperature, and oxygen level of the water are discussed. (auth)

9784 ELECTROCHEMICAL ASPECTS OF STRESS CORROSION OF AUSTENITIC ALLOYS. Bignold, G. J.; Jones, D. deG. (Central Electricity Research Labs., Leatherhead, Eng.). pp 91-94 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

The predominant interest in the stress corrosion of austenitic materials in high-temperature aqueous solutions has been on chloride solutions with less attention given to alkaline solutions which is of concern in nuclear and conventional power plants, especially in PWRs and fast reactors and in conventional "once-through" systems. In deoxygenated solutions austenitic materials are, in fact, more susceptible to sodium hydroxide than equivalent chloride solutions. As part of a generic stress corrosion study of austenitic materials at C.E.R.L., the electrochemical behavior of alloy 800 and 316 stainless steels in alkaline solutions was examined. Experimental details are given and results discussed. (auth)

9785 LABORATORY-SCALE CORROSION TESTS ON ALLOY 800 BOILER TUBING UNDER SIMULATED HIGH-PERFORMANCE BOILER CONDITIONS. Pritchard, A. M. (United Kingdom Atomic Energy Authority, Harwell, Eng.). pp 95-99 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

Results are described of corrosion tests on alloy 800 boiler tubing from different manufacturers with various compositions and heat treatments. Corrosion capsules were manufactured from standard tubing and filled with solutions to produce chemical environments similar to those likely to occur in high-performance boilers at 350°C and above or under normal and fault operating conditions. Part of the wall was thinned by machining to give known stress levels at temperature, and a circumferential weld made with Inconel 82 filler material was made in the thinned wall. Tests were continued for 8000 h or until failure. Despite considerable differences in their metallurgical structures and susceptibilities to chemical sensitization tests, the different specimens showed similar corrosion behavior, the extent and type of attack being largely determined by the solutions in the capsules. Corrosion was slight except in two environments: (i) concentrated chloride solutions with high-pressure oxygen caused extensive pitting and a small amount of cracking, leading to local failure of the wall; (ii) concentration of NaOH $\geq$ 4% caused failure through cracking, which was most marked near the weld. The addition of SiO_2 did not stop cracking in either hydroxide or oxygenated chloride solutions. (auth)

9786 STUDY OF THE CORROSION OF ALLOY 800 IN HIGH-TEMPERATURE STEAM. Leistikow, S. (Kernforschungszentrum, Karlsruhe, Ger.). pp 101-107 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

General corrosion testing of alloy 800 tube material by the General Electric Co. using out-of-pile loops with steam temperatures in the range 430 to 770°C and 70 atm pressure with a surface heat flux of 55 W cm^{-2} and flow velocities of 30 to 60 m/s showed after about 5000 h (a) a relatively moderate loss of metal at a fairly high corrosion rate, (b) a relatively high loss of oxide to the steam phase, and (c) the formation of a zone at the metal surface depleted in chromium by diffusion to the oxide film. Additional corrosion tests in superheated steam of 1000 h duration under isothermal conditions were undertaken and an experimental loop was built to study the effects of high heat fluxes and long exposures of corrosion behavior under conditions as close as possible to those expected in service. Experimental results are given and discussed. (auth)

9787 RESULTS ON INCOLOY 800 AND ALLIED STEAM GENERATOR MATERIALS IN FLORIDA FIELD CORROSION TESTS. Hammond, J. P.; Patriarca, P.; Slaughter, G. M.; Maxwell, W. A. (Oak Ridge National Lab., TN). pp 110-115 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

Appraisals of the isothermal general corrosion of Incoloy 800 in steam at 595 and 650°C indicated good long-term resistance (<7 mg/cm^2 weight gained in 20 years) whether surfaces were ground or electropolished. Electropolished surfaces corroded much faster than ground surfaces in earlier stages, (39 and 15 times as fast in 3000 h at 595 and 650°C, respectively), but the corrosion rate decreased with time and gave comparable estimates over the long term for both surface preparations. Both nonwelded and welded Incoloy 800 were definitely susceptible in chloride stress-corrosion cracking tests of U-bend specimens in a cyclic, wet-dry steam environment. However, C-configuration specimens of Incoloy 800, which were less severely strained, did not crack in this environment. (auth)

9788 SALT CONCENTRATION BY EVAPORATION AND THE SELECTION OF BOILER MATERIALS. Garnsey, R. (Central Electricity Research Labs., Leatherhead, Eng.). pp 120-128 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

Alloy 800 has been proposed as an evaporator material in PWR, HTR, and CFR steam generators. The alloy has excellent resistance to general corrosive attack in aqueous solutions and is more resistant to stress corrosion than the 300 series stainless steels. Operational experience with the alloy is limited; the vast majority of boilers are constructed of ferritic steels. There is little experimental evidence on which to compare the risk of a stress corrosion failure of alloy 800 with that of a general corrosion failure of the ferritic steels in a boiling environment. Evaporation concentrates the many solutes present in boiler water. The boiling process is inherently intermittent and many boiler operations and fault conditions are of limited duration. The boiler tubing is therefore exposed intermittently to a wide concentration range of various aqueous solutions. Evaluation of alloy 800 as an evaporator material thus requires stress corrosion data as a function of solute concentration, temperature and time where exposure is both continuous and intermittent. This paper reviews the factors which determine the chemical environment in the evaporation regions of a boiler. The effects of transient fault conditions are of particular importance. (auth)

9789 COMPATIBILITY OF ALLOY 800 IN HTR ATMOSPHERES. Pearce, R. J. (Central Electricity Research Labs.,

Berkeley, Eng.). pp 129-149 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

A thermodynamic analysis of the behavior of alloy 800 in helium based atmospheres relevant to the HTGCR indicates that, depending upon the precise gas composition, oxidation and carburisation, or carburisation alone may be expected. The prime influence appears to be the moisture level. The morphology and structure of the reaction products are discussed. It is shown that the "reactive" elements Cr, Mn, Ti, and Si are concentrated in the oxide scale which is normally duplex in structure. Al_2O_3 is formed at grain boundaries and in an internal oxidation zone together with Ti and sometimes Si. In carburising conditions, mixed Ti–Cr carbides are formed. When this occurs, intergranular penetration is maximized. Weight gain data are assessed and briefly described and a tentative model for the mechanism of corrosion of alloy 800 in HTR helium is proposed. Areas for further work are identified. (auth)

9790 CORROSION RESISTANCE OF ALLOY 800. Holmes, D. R.; Fidler, R. S.; Manning, M. I. (Central Electricity Research Labs., Leatherhead, Eng.). pp 49-63 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

Basic studies of the oxidation resistance of Fe–Cr binary and Fe–Cr–Ni ternary alloys in pure oxygen have shown that the excellent corrosion resistance of alloy 800 is explicable in terms of the low defect concentrations and diffusion rates in the oxide forming on alloys of this composition in sufficiently oxidizing environments. The performance of alloy 800 in environments of particular importance to nuclear power generation is briefly reviewed to determine to what extent ideas derived from the basic studies of Fe–Cr–Ni ternary alloys are borne out in practice. The good corrosion resistance of alloy 800 in steam and CO_2 and, to some extent, in molten salt environments is in agreement with the behavior of ternary alloys in oxygen. Minor aliovalent alloying additions are only expected to have a significant effect on the oxidation resistance of alloy 800 if they favor the formation of breakthrough duplex oxidation. In impure helium and liquid sodium, dense coherent oxide layers are not formed and so material transport to and from the alloy is not limited by diffusion through the oxide. (auth)

9791 METALLURGY OF ALLOY 800. Stone, P. G. (British Steel Corp., Port Talbot, Eng.); Orr, J.; Guest, J. C. pp 15-40 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

Following a review of published information on the metallurgy of the iron/chromium/nickel system, attention is directed to the metallurgical significance of relatively minor compositional variations introduced in alloy 800 to meet the stress corrosion requirements of the nuclear power industry. These include the effect of C, N, Ti, and Al restrictions in the context of LWR, HTR, and fast reactor applications. Solubility effects are also considered in relation to heat treatment procedures, metallurgical phenomena, and associated properties. The aging behavior is also discussed and related to fabrication and service performance; particularly stress rupture behavior. The effect of strain at ambient and elevated temperatures on these aspects is indicated. (auth)

9792 REVIEW OF THE BEHAVIOR OF ALLOY 800 IN LIQUID SODIUM. Thorley, W. W. (United Kingdom Atomic Energy Authority, Risley, Eng.). pp 185-195 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

Although there is service experience of alloy 800 as tubing for superheaters in conventional and nuclear (HTR) power stations and in PWR heat exchangers, there is no corresponding service experience in sodium-cooled fast reactor steam generators. However, some limited experimental studies have been made of corrosion behavior, and of possible structural modifications and effects on mechanical properties which occur during exposure of this material to a high temperature sodium environment, and these are summarized in the paper. It is concluded that further work needs to be done before alloy 800 can be confidently endorsed for use as tubing in fast reactor steam generators. (auth)

Preparation and Fabrication

9793 (GEPP-172) COLD-DRAWING SHEET MOLYBDENUM AT ROOM TEMPERATURE. Shepherd, L. W. (General Electric Co., St. Petersburg, Fla. (USA). Neutron Devices Dept.). Nov 1975. Contract E(29-2)-656. 19p. Dep. NTIS $4.50.

When sheet molybdenum is cold-drawn and annealed, the microstructure recrystallizes, and may cause the metal to become brittle, with loss of ductility and strength. Ten to twenty percent recrystallization can occur to destroy optimum drawing quality of the metal. A recrystallization of 4 to 5 percent is ideal. It is shown that special tooling and controlled annealing can hold recrystallization to optimum levels. Special tooling includes an automatic cycling press that closely controls the rate of draw and gives maximum pressure. A draw sleeve of high carbon steel is used. The draw sleeve can be highly polished to minimize friction and provides an intensifying effect of the ram force over the entire part. Four draw steps are used, with each step followed by an annealing at 925°C for 20 minutes. Results of recrystallization analysis show that the ideal five percent recrystallization is achieved with this process. (auth)

9794 (RDT-M-4-5T(10-75)) NICKEL–MOLYBDENUM–CHROMIUM ALLOY CASTINGS (ASTM A 494 WITH ADDITIONAL REQUIREMENTS). (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Oct 1975. 6p. RSO.

This standard covers Ni–Mo (15 to 18 percent)–Cr (6 to 8 percent) alloy castings for nuclear and associated applications. The additional requirements include heat treatment, composition, tension tests, weld repair, retesting, examination, quality assurance, etc. (DLC)

9795 EFFECT OF THE REDUCTION PRODUCTS OF TUNGSTIC OXIDE [WOLFRAMITE] ON CHROMIUM–MANGANESE NICKEL-FREE STEEL EP577. Zudin, I. F.; Prokof'ev, D. I.; Bannykh, O. A. pp 39-41 of Vliyanie Fiz.-Khim. Sredy na Zharoprochnost Metal. Materialov. Moscow; Izdatel'stvo Nauka (1974). (In Russian)

Microscopical and x-ray spectral analyses were used to study the structure of the steel EP577(45Kh15G14YuS) [C 0.45, Cr 15, and Mn 14% containing Al and Si] when used during the reduction of WO_3 to W powder in an atmosphere of H. Surface damage of steels can occur as a result of H embrittlement, but service testing over long periods indicates that this steel can replace scarce Ni alloys for use in this process. (Metals Abstr.)

9796 DEPOSITION OF ZIRCONIUM ON LIQUID ZINC WITH A STEADY PULSATING CURRENT. Gold'shtein, S. L.; Rakipov, D. F.; Raspopin, S. P. Elektrokhimiya; 10: No. 9, 1338-1341 (Sep 1974). (In Russian)

The effect of concentration polarization and the initial variations in electrode potential on the hydrodynamic state of the liquid metal/melt interface were studied for the deposition of Zr on liquid Zn using a steady pulsating current. The periodic change in interfacial tension, shown in the pulsating motion of the surface layers of the liquid metal, is mainly associated with charging of the electrical double layer. (Metals Abstr.)

9797 DETERMINATION OF CERTAIN PARAMETERS OF THE STOCKLINE SURFACE BY A RADIOISOTOPE CONTOUR METER. Gudenko, V. N. Stal; No. 8, 682-686(Aug 1974). (In Russian)

The use of a radioisotope stockline contour meter on a blast furnace was investigated. Stockline contours could be recorded along one diametrical section, and it was possible to measure the angle of repose after charging by different systems, to calculate the degree of consolidation of the charge materials, and to analyze the speed of descent of the stockline surface. Characteristic stockline charts are presented. An increase in the speed of descent in the peripheral zone is usually accompanied by a reduction in the axial zone. (Metals Abstr.)

9798 WELDABILITY OF THREE FORMS OF CHEMICALLY VAPOR DEPOSITED TUNGSTEN. Bryant, W. A. (Westinghouse Astronuclear Lab., Pittsburgh); Gold, R. E. Weld. J. (N. Y.); 54: No. 11, 405s-408s(Nov 1975).

Methods were developed for electron beam welding several forms of chemically vapor deposited tungsten. Weld ductility was evaluated from the results of ductile-brittle transition temperature determinations. Welds in tungsten produced from WF_6 were considerably more ductile than those associated with WCl_6-produced tungsten. The larger grain size of the latter material was largely responsible for this behavior. (auth)

9799 REPAIR OF ROTATING AIR-SEALING COMPONENTS FOR GAS TURBINE ENGINES. Lee, J. W. (United Aircraft, East Hartford, CT). Weld. J. (N. Y.); 54: No. 11, 409a-415a(Nov 1975).

From 56th AWS annual meeting; Cleveland, OH (21 Apr 1975).

Weld repair was investigated for gas turbine rotating air-sealing components. Results showed that successful knife-edge restoration can be achieved by either the gas tungsten-arc (GTA) or electron beam (EB) process on Ti-6Al-4V, Ti-8Al-1Mo-1V, and nickel-iron base Incoloy 901 components on a component-by-component basis. Successful flange bolt-hole crack repair can also be made by the GTA process on low alloy steel AMS 6304 components. Particular importance was placed on the low cycle fatigue life of repaired hardware. Knife-edge Ti-6Al-4V and bolt-hole AMS 6304 fatigue specimens were tested. Welded specimen low cycle fatigue lives comparable to those of the base metal specimens were obtained in both alloys. Also, experimental engine testing was conducted on the following components: (1) knife-edge GTA repaired Ti-6Al-4V and Incoloy 901; (2) knife-edge EB repaired Ti-8Al-1Mo-1V; and (3) bolt-hole GTA repaired AMS 6304. Acceptable low cycle fatigue life was attained in each of the weld repaired components. Weld repair procedures have been established and incorporated in applicable engine overhaul manuals for field service use. (auth)

9800 PLATING METHOD OF TANTALUM FOR CONTAINER WALLS IN CHEMICAL ENGINEERING. Jaehn, F.; Pruemmer, R. (Institut fuer Chemie der Treib- und Explosivstoffe, Pfinztal-Berghausen (F.R. Germany)); Liesner, C. (Heraeus (W.C.) G.m.b.H., Hanau (F.R. Germany)). Metall; 28: No. 10, 957-959 (Oct 1974). (In German)

Starting with thick tantalum and copper sheets, a compound is made by explosive welding which can be rolled onto tantalum layers up to about 0.1 mm without intermediate annealing. This semiproduct can be treated in the same way as massive sheet metal, e.g. by explosive plating of stranded copper onto steel. The area with 0.1 mm thickness of tantalum is completely sufficient for technical processing purposes. (GE)

9801 WELDING IN REACTOR AND CONTAINER FABRICATION. Straub, H. (Sulzer Bros. Ltd., Winterthur (Switzerland)). pp 15-23 of Welding of Containers and Pipes. Duesseldorf, F.R. Germany; Deutscher Verlag fuer Schweisstechnik (1975). (In German)

From welding-engineering seminar and special meeting "welding of containers and pipes"; Muenchen, F.R. Germany (27 Jan 1975). 24 figs.; 6 refs. With abstract.

The development of welding practice is a decisive factor for progress in the field of reactor and container construction. To ensure proper welding, the welding material should have special properties which are specified in the article. Some practical examples show the various problems. The tendency is towards automation and completely welded structural components. (GE)

9802 WELDING OF NOZZLES TO PIPES AND CONTAINERS. Marek, A. (Simmering-Graz-Pauker A. G., Vienna (Austria)). pp 31-38 of Welding of Containers and Pipes. Duesseldorf, F.R. Germany; Deutscher Verlag fuer Schweisstechnik (1975). (In German)

From welding-engineering seminar and special meeting "welding of containers and pipes"; Muenchen, F.R. Germany (27 Jan 1975). 11 figs.; 17 refs. With abstract.

Some constructive examples are given for different kinds of welding seams for the welding of nozzles to pipes, containers and pressure vessels. The welding methods offer good possibilities for greater operating safety and stress reduction. (GE)

9803 BOILER TUBE MANUFACTURE. Gullberg, R. (Sandvik AB, Sweden). pp 41-44 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

In boiler tube manufacture it is necessary to pay special attention to the mechanical properties, corrosion resistance, and freedom from defects of the product. These properties are affected by both composition and production methods. The production route for boiler tubes at SANDVIK is described. The merits of pilgering and drawing as cold working methods are discussed. A tube mill especially designed for making PWR steam generator tubing is described. Finally the importance of a well-developed quality control system for successful tube manufacture is stressed. (auth)

9804 OPERATING EXPERIENCE WITH PLUTONIUM MATERIALS IN EXPERIMENTAL REACTORS. Lloyd, R. C.; Bierman, S. R.; Clayton, E. D. (Battelle Pacific Northwest Labs., Richland, WA). pp 70-71 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).

From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

9805 WELDING AND FABRICATION OF ALLOY 800 WITH EMPHASIS ON THE DEVELOPMENT OF TECHNIQUES SUITED TO STEAM GENERATOR PLANT. Henderson, L.; Campbell, D. J. (Clarke Chapman-John Thompson Ltd., Gateshead, Eng.). pp 285-316 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

The subject is dealt with under the following headings: alloy 800 properties related to fabrication; development of T.I.G. orbital welding of alloy 800 and temperature profile measurement techniques; machine welding developments; vacuum brazing of alloy 800; friction welding of alloy 800; heat treatment of alloy 800. (UK)

9806 WELDING OF ALLOY 800. Ward, M.; Norman, P. L. pp 319-339 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

This paper reviews the technical literature published on the welding of alloy 800. Much of this work has been carried out using the Varestraint and Gleeble tests to investigate the susceptibility of the alloy and of high nickel consumables to hot-cracking. In spite of much reported work, it is pointed out that many years of experience in the use of alloy 800 shows it to be readily weldable without any major problems occurring due to hot-cracking. Elements investigated include Ti, Al, S, P, and C, and the effects of these elements are discussed in terms of their effects on the hot-ductility curves obtained by Gleeble testing. Conclusions reached by various researchers state that the individual effects of the above five elements may be masked by other unknown factors. It is concluded that with correct welding procedures alloy 800 can be welded without cracking problems even with high heat input welding processes using either high-nickel filler wires or a matching electrode. Matching composition filler wires have been used with success but none are at present available commercially. (auth)

9807 ALLOY 800 WELDING EXPERIENCE AT UKAEA SPRINGFIELDS. Taylor, A. F. pp 341-344 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

Investigations into the welding of alloy 800 at the Reactor Fuel Element Laboratories, Springfields, commenced about three years ago following an extended development program on tube to tube plate welding of low alloy and stainless steels for PFR. The techniques and approach developed for critical fuel element welding applications had proved equally suitable for the precision welding requirements on the much heavier sections of heat exchangers. It had been demonstrated that the same control of weld quality and profile could be achieved with consistency and the permissible range of critical parameters could be readily defined. Because of this, development work was continued to include other materials, such as alloy 800, which might be of potential use. The tungsten inert gas arc welding process is used, and the equipment, including the control system, is described. Tube to tube-plate welding, and tube to tube butt welding, are discussed. (auth)

9808 THERMAL REDUCTION OF EUROPIUM OXIDE BY ALUMINUM. Grjotheim, K.; de Godoy, J. M.; Herstad, O. Metalurgia (Sao Paulo); 30: No. 199, 383-386(Jun 1974). (In Portuguese).

Small particles of compacted mixtures of Al powder and Eu_2O_3 were processed in an effusion cell. An experiment with a molar ratio Eu_2O_3 : Al of 3:2 conducted at a temperature of 930°C in a vacuum of 10^{-5} torr and lasting 30 min gave a product containing EuO and 3 $EuO.Al_2O_3$. The addition of Al to this product resulted, under the same processing conditions, in a decrease in the amount of EuO and an increase in 3 $EuO.Al_2O_3$, while metallic Eu was vaporized from the sample. However, the addition of Al to a residue containing only 3 $EuO.Al_2O_3$ produced $EuO.Al_2O_3$ and metallic Eu of considerable purity. Based on this information, a three-reaction mechanism for the aluminothermal reduction of Eu_2O_3 was established. During reactions at 1200 to 1250°C, a new condensed phase not identical to $EuO.6Al_2O_3$ was produced. Vapor pressures of the systems $EuO-Al-3\ EuO.Al_2O_3$ and $3\ EuO.Al_2O_3-Al-EuO.Al_2O_3$ and equilibrium reaction pressures were measured; the thermodynamic properties of the aluminates 3 $EuO.Al_2O_3$ and $EuO.Al_2O_3$ were calculated. Process efficiency for reactions carried out at 980 ± 10°C was 62.5%. Attempts to improve the yield of metallic Eu failed because of the complexity of the vapor produced at the higher temperature required (1200 to 1250°C). (Metals Abstr.)

9809 WELDABLE, AGE HARDENABLE, AUSTENITIC STAINLESS STEEL. Brooks, J. A.; Krenzer, R. W. (to U. S. Energy Research and Development Administration). US Patent 3,895,939. C22C38/06; C22C38/44; C22C38/46; C22C38/50. 22 Jul 1975. Filed date 31 Oct 1973. 10p.

An age hardenable, austenitic stainless steel having superior weldability properties as well as resistance to degradation of properties in a hydrogen atmosphere is described. It has a composition of from about 24.0 to about 34.0 weight percent (w/o) nickel, from about 13.5 to about 16.0 w/o chromium, from about 1.9 to about 2.3 w/o titanium, from about 1.0 to about 1.5 w/o molybdenum, from about 0.01 to about 0.05 w/o carbon, from about 0 to about 0.25 w/o manganese, from about 0 to about 0.01 w/o phosphorous and preferably about 0.005 w/o maximum, from about 0 to about 0.010 w/o sulfur and preferably about 0.005 w/o maximum, from about 0 to about 0.25 w/o silicon, from about 0.1 to about 0.35 w/o aluminum, from about 0.10 to about 0.50 w/o vanadium, from about 0 to about 0.0015 w/o boron, and the balance essentially iron. (auth)

9810 PROCESS FOR ELECTROSLAG REFINING OF URANIUM AND URANIUM ALLOYS. Lewis, P. S. Jr.; Agee, W. A.; Bullock, J. S. IV; Condon, J. B. (to U. S. Energy Research and Development Administration). US Patent 3,895,935. C22B4/00. 22 Jul 1975. Filed date 16 Dec 1974. 6p.

A process is described for electroslag refining of uranium and uranium alloys wherein molten uranium and uranium alloys are melted in a molten layer of a fluoride slag containing up to about 8 weight percent calcium metal. The calcium metal reduces oxides in the uranium and uranium alloys to provide them with an oxygen content of less than 100 parts per million. (auth)

9811 DISPLACED ELECTRODE PROCESS FOR WELDING. Heichel, L. J. (to U. S. Energy Research and Development Administration). US Patent 3,902,038. B23K31/06. 26 Aug 1975. Filed Date 22 Jul 1974. 4p.

PAT-APPL-490,446.

A method is described for the butt-welding of a relatively heavy mass to a relatively small mass such as a thin-wall tube. In butt-welding heat is normally applied at the joint between the two pieces which are butt-welded together. The application of heat at the joint results in overheating the tube which causes thinning of the tube walls and porosity in the tube material. This is eliminated by displacing the welding electrode away from the seam toward the heavier mass so that heat is applied to the heavy mass and not at the butt seam. Examples of the parameters used in welding fuel rods are given. The cladding and end plugs were made of Zircalloy. The electrode used was of 2 percent thoriated tungsten. (auth)

Properties, Structure, and Phase Studies

Refer also to abstracts 8833, 8871, 9927, 9934, 10277, 10588, 10593, 10594, 11212, and 11230.

9812 (FRNC-TH-528) CONTRIBUTION TO THE STUDY OF THE CRYSTAL FIELD IN RARE EARTH ALLOYS. Moessbauer Effect on ^{161}Dy. Iraldi, R. (Grenoble-1 Univ., 38 (France)). 1974. vp. (In French). INIS.

Thesis.

Hyperfine interactions in Dy–Y and Dy–Sc alloys were studied using Moessbauer effect on ^{161}Dy. It was shown that all RE–RE and RE–Y alloys are equivalents systems as for the conduction electron structure and magnetic properties, when crystal fields and anisotropy effects are taken into account. On the other hand, quadrupolar interaction studies in Dy–Sc alloys showed that in these alloys electronic properties vary considerably with the concentration of Sc. These results are interpreted as being due to pressure effect that changes the properties of conduction electrons. A high charge density at the nucleus in Dy–Sc was observed. This phenomenon is also interpreted as being due to a pressure effect on dysprosium external shells. (FR)

9813 (INIS-mf-1786) MAGNETIC INSTABILITIES IN COUPLED SYSTEMS. Application to Actinide Metals. Continentino, M. A. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil). Instituto de Fisica). Dec 1973. 142p. (In Portuguese). INIS.

Conditions are determined for magnetic instabilities in systems with coupled bands in application to actinide metals. These conditions are obtained in the limit of broad bands (Hartree–Fock approximation) and in the strong correlation limit (Hubbard—approximation). The effect of the d-f hibridization in the density of states is qualitatively discussed. (INIS)

9814 (IS-M-56) MAGNETIC MOMENTS OF FERROMAGNETIC GADOLINIUM ALLOYS. White, H. W.; Beaudry, B. J.; Burgardt, P.; Legvold, S.; Harmon, B. N. (Ames Lab., Iowa (USA); Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Physics). 1975. 7p. (CONF-751209-69). Dep. NTIS $4.50.

From 21st annual conference on magnetism and magnetic materials; Philadelphia, Pennsylvania, USA (9 Dec 1975).

Saturation magnetization and lattice parameter measurements have been made on samples of polycrystalline and single crystal c-axis gadolinium and on samples of polycrystalline gadolinium alloyed with scandium, yttrium, lutetium, lanthanum, magnesium, ytterbium and thorium. The magnetic measurements were made near 4.2^{0}K in fields up to 30 kOe. Alloy concentrations ranged up to 30 atomic percent. For pure single crystal gadolinium the saturation moment was measured to be 7.63 +- .01 mu/sub B/ per gadolinium atom. This result indicates the conduction electron contribution is about 13 percent higher than the value obtained from earlier measurements. For polycrystalline gadolinium the saturation moment per atom was found to be 7.555 +- .015 mu/sub B/. The excess moment per Gd atom for the polycrystalline alloys fell near a straight line when plotted as a function of the unit cell axes ratio c/a. The c/a ratios ranged from 1.583 to 1.595 and the excess moments were between 0.78 and 0.44 mu/sub B/. There was no correlation of excess moment with atomic volume or with the valence of the solute atoms. (auth)

9815 (ORNL-TM-5028) HIGH-STRAIN-RATE TENSILE PROPERTIES OF ANNEALED 2 1/4 Cr-1 Mo STEEL. Klueh, R. L.; Oakes, R. E. Jr. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 18p. AT.

The high-strain-rate tensile properties of annealed 2¼ Cr–1 Mo steel were determined and the tensile behavior from 25 to 566^{0}C and strain rates of 2.67 x 10^{-8} to 144/s are described. Above 0.1/s at 25^{0}C, both the yield stress and the ultimate tensile strength increased rapidly with increasing strain rate. As the temperature was increased, a dynamic strain aging peak appeared in the ultimate tensile strength-temperature curves. The peak height was a maximum at about 350^{0}C and 2.67 x 10^{-6}/s. With increasing strain rate, a peak of decreased height occurred at progressively higher temperatures. The major effect of strain rate on ductility occurred at elevated temperatures, where a decrease in strain rate caused an increase in total elongation and reduction of area. (auth)

9816 (UCID-16956) THERMOPHYSICAL MEASUREMENTS ON METALS UP TO 0.4 GPa and 8000^{0}K. Shaner, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Nov 1975. Contract W-7405-ENG-48. 16p. Dep. NTIS $4.50.

Experimental techniques for thermophysical measurements on liquid metals in the 0.4 GPa and 8000^{0}K range are described. Examples of the kind of data obtained for tantalum are presented. (auth)

9817 ROLE OF SLIP AT GRAIN BOUNDARIES IN THE HIGH TEMPERATURE CREEP OF TUNGSTEN. Mordyuk, V. S.; Ruchin, V. I.; Sinitsyn, G. F. pp 113-117 of Vliyanie Fiz.-Khim. Sredy na Zharoprochnost Metal. Materialov. Moscow; Izdatel'stvo Nauka (1974). (In Russian)

Results are given from studies of slip at grain boundaries in W wire specimens of various impurity contents. An assessment is made of the contribution of grain boundary deformation to the total elongation during creep in the range 2,200-2,800°C. (Metals Abstr.)

9818 NONDESTRUCTIVE INSPECTION OF THE QUALITY OF HEAT TREATMENT OF PARTS MADE FROM BrB2 BERYLLIUM BRONZE. Pushin, N. T.; Zverev, V. I.; Okkel'man, N. G.; Irisov, V. M. Sov. J. Nondestr. Test. (Engl. Transl.); 11: No. 1, 33-36(1975).

Translated from Defektoskopiya; 11: No. 1, 45-49(1975).

The investigation was concerned with the relationship between electrical and mechanical properties of beryllium bronze in various heat-treated conditions. These included changes in chemical composition (beryllium content) as specified in the relevant GOST specification. Some suggestions are made on replacement of the conventional quality inspection methods by one involving the measurement of electrical conductivity. (auth)

9819 PHASE DIAGRAM OF THE TERNARY ALLOYS OF Al–Cu–Cd. Cheng, C. H.; Chen, J. C.; Li, T. H. Wu Li Hsueh Pao; 24: No. 3, 174-179(May 1975). (In Chinese)

The phase diagram of the ternary alloys of Al–Cu–Cd was determined by the x-ray diffraction technique. The room temperature isothermal cross section consists of: 12 single-phase regions, 21 two-phase regions and 13 three-phase regions. All the single phases are the same as those in the three binary systems. No new phase has been observed. (JPRS)

9820 INVESTIGATION OF STRUCTURAL CHANGES IN A NIOBIUM ALLOY DURING VACUUM-CREEP TESTING. Rybakov, S. V.; Shatinskii, V. F.; Eliseev, A. I. (Physical Mechanical

Inst., Kiev). Probl. Prochnosti; No. 4, 120-122(Apr 1975). (In Russian)

Creep of a niobium alloy at 1100°C in a vacuum and under a load varying from 4 to 10 kg/mm² was studied for the purpose of determining gas impregnation when the alloy contained Zr, Mo, and Ta. Of the gaseous elements in the residual gases in the vacuum (C, N, O, and H), oxygen is the element that is predominantly impregnated into the alloy. Saturation of oxygen leads to precipitation of zirconium oxides in the grain boundaries and their diffusion to the surface and in turn a retardation of any further diffusion of oxygen from the residual gases. This process increases the niobium alloy strength. (JPRS)

9821 STRUCTURE BLOCK STACKING IN INTERMETALLIC COMPOUNDS. I. The Rhombohedral-Hexagonal $M_{n+1}X_{5n-1}$ and the Monoclinic-Hexagonal-Trigonal-Orthorhombic $M_{n+1}X_{5n+2}$ Structure Series. Parthe, E.; Lemaire, R. (Univ., Geneva). Acta Crystallogr., Sect. B; 31: No. 7, 1879-1889(15 Jul 1975).

In binary systems containing rare-earth elements (M) and transition elements (X), several intermetallic compounds with composition between MX_2 and MX_5 are formed which, according to their mechanical properties, fall into two groups. The brittle alloys are hexagonal or rhombohedral and belong to the $M_{n+1}X_{5n-1}$ structure series. This series may be considered to be formed by stacking M_2X_4 blocks (characteristic of Laves phases) with a varying number of MX_5 blocks (characteristic of the Haucke phase $CaCu_5$). The soft alloys with pronounced cleavage have monoclinic symmetry. They belong to a new $M_{n+1}X_{5n+2}$ structure series which contains a new structure block, M_2X_7, found in the Zr_2Ni_7 structure. A consideration of the intraplanar translation vectors and of the possible rotations of the M_2X_7 blocks shows that this structure series has three other subseries apart from the monoclinic Zr_2Ni_7 sub-series, these being hexagonal, trigonal and orthorhombic. Point positions for these hypothetical structures are given together with a ready method of recognizing their presence from precession photographs. (auth)

9822 STRUCTURE OF PuPd. Cromer, D. I. (Los Alamos Scientific Lab., NM). Acta Crystallogr., Sect. B; 31: No. 6, 1760-1761(15 Jun 1975).

For PuPd: Pnma, Z = 4, a = 7.036 (4), b = 4.550 (2), c = 5.663 (2) Å, Q_c = 12.65 g cm^{-3}. This structure is of the B27, FeB type. (auth)

9823 STRUCTURE OF Pu_5Pt_3. Cromer, D. T.; Larson, A. C. (Los Alamos Scientific Lab., NM). Acta Crystallogr., Sect. B; 31: No. 6, 1758-1759(15 Jun 1975).

For Pu_5Pt_3: $P6_3/mcm$, Z = 2, a = 8.490 (2), c = 6.084 (2) Å, Q_c = 15.57 g cm^{-3}. This structure is of the $D8_8$, Mn_5Si_3 type. (auth)

9824 STRUCTURE OF Pu_5Ru_3. Cromer, D. T.; Larson, A. C.; Roof, R. B. (Los Alamos Scientific Lab., NM). Acta Crystallogr., Sect. B; 31: No. 6, 1756-1757(15 Jun 1975).

For Pu_5Ru_3: I4/mcm, Z = 4, a = 10.745 (3), c = 5.719 (2) Å, Q_c = 15.07 g cm^{-3}. This structure is of the $D8_m$, W_5Si_3 type. (auth)

9825 ATOMIC POSITIONS IN U_3Si. Kimmel, G. (Israel Atomic Energy Commission, Beersheba); Nadiv, S. Acta Crystallogr., Sect. B; 31: No. 5, 1351-1353(15 May 1975).

Positions of the atoms in the unit cell of U_3Si were re-examined. The best fit with x-ray diffraction spectra was obtained in the space group I4/mcm(D_{4h}^{18}) [origins (0,0,0), ($\frac{1}{2},\frac{1}{2},\frac{1}{2}$)] with the following atomic positions: four U(1) at (0,$\frac{1}{2}$,$\frac{1}{4}$), ($\frac{1}{2}$,0,$\frac{1}{4}$); eight U(2) at ±(u,u, + $\frac{1}{2}$,0), ±(u + $\frac{1}{2}$, $\bar{u}$,0) (u = 0.226 ± 0.002); four Si at ±(0,0,$\frac{1}{4}$). (auth)

9826 X-RAY MEASUREMENTS OF STRAIN AND MOSAIC PARTICLE SIZE IN ANNEALED TUNGSTEN POWDER. Urban, J. P. (Univ. of the Witwatersrand, Johannesburg). J. Appl. Crystallogr.; 8: No. 4, 459-464(1 Aug 1975).

X-ray line profiles of annealed tungsten powder of 99.9% purity were measured with a high resolution of the order of 0.01° (2θ). A primary beam of Mo, Kα$_1$ radiation which had a divergence of less than 0.01° in the plane of the diffractometer was used. After elimination of all instrumental effects, the mosaic particle-size broadening and the strain broadening were obtained. With the approximation of spherical particles, a generalized Maxwellian mass distribution with a mean particle radius of 2500 Å and a poly-dispersity of 25% was found. A strain of 3.6×10^{-4} in the mosaic particles was observed. Results are compared with various theories of x-ray scattering from dislocation arrangements. Two interpretations of the strains are discussed. The strains originate either from dislocations in the walls of the mosaics or from dislocations inside the mosaics. In the latter case less than two dislocations are present in the mosaic particles. The strain broadening function was found to be Gaussian for strains less than 2×10^{-4} and to be above the Gaussian function for larger strains. (auth)

9827 ^{121}Sb MOESSBAUER STUDIES ON $NbSb_2$ AND $TaSb_2$. Brattaas, L. (Oslo Univ.); Kjekshus, A., Nicholson, D. G.; Donaldson, J. D.; Southern, J. T. Acta Chem. Scand., Ser. A; 29: No. 2, 217-219(1975).

^{121}Sb Möessbauer spectra of $NbSb_2$ and $TaSb_2$ were obtained at 4.2°K and are discussed in relation to their $NbAs_2$ type structure. (auth)

9828 COMMENT ON A PAPER BY D. E. YELDHAM AND R. BROOK "EFFECT OF PRESTRAIN ON THE STRESS-RUPTURE PROPERTIES OF 2.25% CHROMIUM–1% MOLYBDENUM STEEL". Mack, W. C.; Yeldham, D. E.; Brook, R. Met. Technol.; 1: No. 12, 551(Dec 1974).

Results of creep-rupture strength tests on Croloy 2¼ are not in agreement with the conclusion of Yeldham and Brook (Y.-B.) whose tests were carried out for shorter times and at lower temperatures, that prestraining the steel by ≤ 15% cold work improves the creep-rupture strength. In a reply, Y.-B. concur that the generality implied, in their conclusions does not agree with M.'s data. (Metals Abstr.)

9829 EFFECT OF PRESTRAIN ON THE STRESS-RUPTURE PROPERTIES OF 2.25% CHROMIUM–1% MOLYBDENUM STEEL. Yeldham, D. E.; Brook, R. Met. Technol.; 1: No. 4, 199-201(Apr 1974).

Specimens from a commercial cast of a 0.11%C–2.2%Cr–1.0% Mo steel were normalized at 950°C and tempered at 720°C. Some specimens were then pre-strained in tension by either 10 or 15%. Creep-rupture tests were made within the stress range 140-200 N/mm², the full tensile load only being applied when the specimen reached 550°C. It was concluded that prestraining a 2.25% Cr–1.0 Mo steel by up to 15% cold work produces a related improvement in creep-rupture strength, but does not alter the rupture ductility, demonstrating the ability of the steel to withstand considerable deformation without detriment to its high-service-temperature performance. Stress-accelerated recovery occurs in the pre-strained material; no further advantage is gained from prior deformation once the prestrained material has recovered fully. (Metals Abstr.)

9830 STRENGTHENING DUE TO NIOBIUM AND MOLYBDENUM IN THE HIGH-TEMPERATURE CREEP OF ZIRCONIUM–NIOBIUM AND ZIRCONIUM–MOLYBDENUM ALLOYS. Pahutova, M.; Cadek, J. Kovove Mater.; 12: No. 5, 677-682(1974). (In Czech)

Strengthening of Zr–Nb and Zr–Mo alloys as a function of Nb and Mo concentration, respectively, was measured by determining the applied stress, σ_s, corresponding to the stationary creep as measured at the same temperature (500°C). The effect of Mo is much greater than that of Nb. (Metals Abstr.)

9831 ADSORPTION OF SILICON ON TUNGSTEN. Zubenko, Yu. V.; Marinova, T. S. Bulg. J. Phys.; 1: No. 1, 70-79(1974). (In Russian)

The adsorption of Si on a W single crystal in a field emission microscope was investigated. The work function increased monotonically to a value of 4.9 eV as a result of the migration of Si over the emitter tip at 1300°K. The electric field at the surface of the emitter tip increases the accumulation of adatoms on (001) faces, irrespective of the direction of the field, and suggests that adatoms of Si are polarized only by the external field. (Metals Abstr.)

9832 T_c AND ITS PRESSURE DEPENDENCE FOR TECHNETIUM-BASED HCP. Shelton, R. N. (Univ. of California, La Jolla, San Diego); Smith, T. F.; Koch, C. C.; Gardner, W. E. J. Phys., F (London); 5: No. 10, 1916-1930(Oct 1975).

The superconducting transition temperature T_c was determined for a number of technetium-based hcp solid solution alloys. Additions of V, Nb, and Mo raise T_c, whereas Co, Ni, Ru, and, in particular, Cr and Fe lower T_c relative to pure technetium. The general trend of T_c with the electron per atom ratio is consistent with that expected for a simple dependence on a rigid-band density of states, with the exception of that for the Cr and Fe alloys. An analysis of the data for these latter alloys in the context of the theory due to Kaiser would suggest that the enhanced depression of T_c is due to the formation of a nonmagnetic resonance state. The hydrostatic pressure dependence of T_c was investigated up to 25 kbar with particular attention given to the hcp region of the Mo–Tc–Ru system. The observed variation of $\partial T/\partial P$ is discussed in relation to current theoretical models. (auth)

9833 EFFECT OF HYDROGEN ON THE SUPERCONDUCTING AND STRUCTURAL PROPERTIES OF BCC Nb–Ru ALLOYS.

Robbins, C. G.; Ishikawa, M.; Treyvaud, A.; Muller, J. (Geneva Univ.). Solid State Commun.; 17: No. 7, 903-906(1 Oct 1975).

The superconducting transition temperature (T_c) was measured before and after the introduction of hydrogen into $Nb_{(1-x)}Ru_x$ ($0.20 \leq x \leq 0.33$). In all cases, the presence of appreciable amounts of this interstitial component led to a sharp increase in the T_c. All the evidence suggests that conversion of the host metal lattice to fcc is necessary for the appearance of the elevated T_c. (auth)

9834 SUPERCONDUCTING CRITICAL CURRENT OF SPUTTERED Nb–Ge FILMS. Testardi, L. R. (Bell Labs., Murray Hill, NJ). Solid State Commun.; 17: No. 7, 871-874 (1 Oct 1975).

The temperature dependence of the superconducting critical current density $J_c(T)$ in zero applied field from 4.2°K to T_c was measured for 15 films of Nb–Ge with varying composition, deposition conditions, and radiation damage. Results show (i) the enhanced superconductivity observed in stoichiometric Nb_3Ge as well as nonstoichiometric films is bulk like rather than filamentary, (ii) a simple correlation of the form $J_c(O) \alpha e^{T_c/T_0}$ which is reasonably independent of how the T_c has been achieved, and (iii) some additional evidence that the enhanced T_c of the films is not due to their chemical composition alone. (auth)

9835 CALCULATION OF ANISOTROPY EFFECTS IN COMPTON PROFILES OF CRYSTALS. Aikala, O. (Turku Univ., Finland). Philos. Mag.; 32: No. 2, 333-341(Aug 1975).

The anisotropy effects in the Compton profiles of crystals are considered, using linear combinations of atomic orbitals based on Löwdin's (Löwdin, P.-O., 1956, Adv. Phys., 5, 1) symmetrical orthogonalization method. General expressions of the directional dependences are obtained for primitive crystals composed of atoms (or ions) with completely occupied subshells. The main directions (100), (110), and (111) in cubic crystals are considered in more detail. The Compton profiles in these directions are calculated for the Ca crystal with fcc structure. Some calculations are also carried out for metallic vanadium (fcc structure) and are compared with experimental and other theoretical data. (auth)

9836 EFFECT OF ADDITIONS OF SMALL AMOUNTS OF RARE EARTH METALS ON THE PROPERTIES OF CAST TITANIUM AND COBALT. Kashchuk, V. A.; Cherkashin, A. I.; Karelin, A. G. Izv. Akad. Nauk SSSR, Met.; No. 2, 133-135 (1975). (In Russian)

Titanium alloys were melted in a vacuum arc furnace of the laboratory type in a refrigerated copper crystallizer with a diameter of 85 mm. The residual pressure in the furnace during melting was 2×10^{-3} to 5×10^{-3} mm Hg. The melt of cobalt alloys was transmitted through an LPZ-67 assembly in an atmosphere of neutral argon gas. Additions of rare earth metals were introduced to the melt in the form of ligatures of Co-Me and Ti-Me. Testing of the mechanical properties of titanium alloys were then performed on cast specimens heated to 750°C. The values for residual induction of the cobalt alloys were determined by the Steblein method, while coercive force was measured in a solenoid by drawing the specimen through a coil connected to a ballistic galvanometer. Additions of rare earth metals (up to 0.1 to 0.2 at percent) reduced the grain of cast titanium, increased its electrical resistance and durability while slightly reducing relative elongation. The metals can be used for increasing durability and improving technical properties of alloys based on α-titanium. Additions of rare earth metals also reduced cast cobalt in amounts up to 0.15 at.%, increasing its electrical resistance and improving its magnetic properties. They can be used to improve the qualities of cobalt alloys. (JPRS)

9837 NATURE OF THE INITIAL STAGE OF BERYLLIUM STRENGTHENING. Khristenko, I. N.; Papirov, I. I. (Physical-Technical Inst., Kiev). Probl. Prochnosti; No. 3, 115-116 (Mar 1975). (In Russian)

Strain curves for a number of metals are discussed, and the equations for determining the curves are modified to apply to beryllium. From these curves it was concluded that additional strengthening of beryllium in the initial stage of straining can be linked with an increase in the density of mobile dislocations. It is suggested that the density of mobile dislocations grows spasmodically until reaching the yield point after which the density becomes almost constant. Also, when elastic limit is reached there occurs either tearing of the first dislocations from those already in the crystal or nucleation of new mobile dislocations. In the first case the density of immobile dislocations is diminished. In the initial stage of plastic deformation the magnitude of mobile dislocation density increases significantly and then becomes constant. Density of immobile dislocations increases linearly with strain. This process has a dynamic nature and includes acts of tearing, nucleation of new dislocations, their immobilization, annihilation, and exit to grain boundaries or to the crystal surface. (JPRS)

9838 INFLUENCE OF F-D INTERACTIONS ON EFFECTIVE CRYSTAL FIELDS SEEN BY 4f ELECTRONS IN THE HEAVY RARE EARTH METALS. Eagles, D. M. (Commonwealth Scientific and Industrial Research Organization, Chippendale (Australia). National Measurement Lab.). Z. Phys., B; 21: No. 2, 171-176(Jun 1975).

A method is given for determination of the influence of f-d interactions on the effective crystal field seen by 4f shells in a previously published model for 5d electrons in the heavy rare earth metals. With the ratios of effective i-th order fields felt by 4f shells to those acting on 5d electrons denoted by multiplication factors M_i, it is shown that M_2 lies between -2 and -6 for five metals, Tb, Dy, Ho, Er, and Tm. The factor M_4 is also negative for all the heavy rare earths except Tm. It is larger in magnitude than M_2, and varies quite sharply from one metal to another. (auth)

9839 KONDO ANOMALIES OF HEAT CONDUCTIVITY AND LORENZ RATIO IN NORMAL STATE (La,Ce)Al_2. Moeser, J. H.; Steglich, F. (Koeln Univ. (F.R. Germany). 2. Physikalisches Inst.). Z. Phys., B; 21: No. 2, 165-170(Jun 1975).

The thermal conductivity of $LaAl_2$ and of two dilute (La,Ce)Al_2 alloys was measured in the normal state between 0.4 and 8°K. From the lattice conductivity of $LaAl_2$ a high dislocation density N_d caused by the arc melting process can be inferred. After annealing N_d is reduced by an order of magnitude. For the (La, Ce)Al_2 samples minima are observed at 5°K in the $W^e \times T$ vs. T curves (W^e = electronic thermal resistivity). Below 1°K the quantity $W^e \times T$ is linear in $(-\ln T)$. The electronic Lorenz ratio $L^e(T) = p(T)/W^e(T) \times T$ shows a maximum at 2°K with a value 23% above $L^e(O)$. It is the first time that this Kondo anomaly is established in its full temperature dependence. (auth)

9840 X-RAY DIFFRACTION STUDY OF THE STRUCTURE OF AMORPHOUS $Cu_{57}-Zr_{43}$ ALLOY. Waseda, Y. (Tohoku Univ., Sendai (Japan). Research Inst. of Mineral Dressing and Metallurgy); Masumoto, T. (Tohoku Univ., Sendai (Japan). Research Inst. for Iron, Steel and Other Metals). Z. Phys., B; 21: No. 3, 235-240(1975).

X-ray diffraction patterns have been obtained from a $Cu_{57}-Zr_{43}$ alloy in both amorphous and liquid states. After calculating the structure factor by means of the common Fourier analysis, the atomic radial distribution function was evaluated from which interatomic distance and coordination number were obtained. The essential features of the structure factor in the amorphous state were quite similar to that in the liquid state. There is a good agreement between the structure factor determined in this study and that calculated on the basis of the hard sphere mixture model except for the presence of the splitting of a second peak maximum in the former. These results suggest that the atoms in the nearest neighbor distance in the amorphous state are mainly the same disorderly distributed atoms as those in the liquid state. But a deformed crystalline-like arrangement of atoms as those in a hcp or fcc structure contributes partly to the short range order in the amorphous state. (auth)

9841 MAGNETIC SUSCEPTIBILITY OF (La,Ce)Al_2 ALLOYS. Felsch, W.; Winzer, K.; Minnigerode, G. V. (Goettingen Univ. (F.R. Germany). 1. Physikalisches Inst.). Z. Phys., B; 21: No. 2, 151-156(Jun 1975).

The low-field magnetic susceptibility of (La,Ce)Al_2 alloys with 1 to 20 at.% Ce was measured between 0.04 and 4°K. Up to 1.5 at.% Ce the impurity contribution to the susceptibility exhibits features which can be described in terms of a combined influence of the crystalline electric field and the Kondo effect. At very low temperatures the onset of interactions between the Ce impurities is indicated. The impurity coupling interactions determine the dependence on temperature and concentration of the more concentrated alloys. For the dilute alloys the impurity magnetization was determined from measurements of the susceptibility in magnetic fields up to 10 kOe. The magnetization as a function of temperature and field shows a typical anomaly which has also been observed in other Kondo systems. (auth)

9842 MARTENSITIC CRYSTAL STRUCTURE TRANSFORMATION IN CsCl-TYPE ALLOYS YCu, LaCd, AND $LaAg_xIn_{1-x}$. Balster, H.; Ihrig, H.; Methfessel, S. (Bochum Univ. (F.R. Germany). Abt. fuer Physik und Astronomie); Kockel, A. (Bochum Univ. (F.R. Germany). Inst. fuer Mineralogie). Z. Phys., B; 21: No. 3, 241-245(1975).

In the temperature dependence of the electrical resistivity of CsCl-type alloys YCu and LaCd and in the pseudobinary system $LaAg_xIn_{1-x}$, a hysteresis was observed that is typical of a martensitic crystal structure transformation. The x-ray spectra of polycrystalline samples show at low temperatures line splittings

corresponding to a cubic-to-tetragonal transformation of the CsCl structure. The concentration dependence of the lattice parameters in $LaAg_xIn_{1-x}$ is given at 300, 90 and 33°K. The x-dependence of the transition temperature has been investigated, in order to discuss the influence of the electron concentration on the structure transformation. (auth)

9843 STRUCTURE AND EFFECTIVE INTERIONIC POTENTIAL OF LIQUID PALLADIUM, PLATINUM, AND ZIRCONIUM. Waseda, Y.; Ohtani, M. (Tohoku Univ., Sendai (Japan). Research Inst. of Mineral Dressing and Metallurgy). Z. Phys., B; 21: No. 3, 229-234(1975).

The structure of palladium, platinum, and zirconium in the liquid state was studied by x-ray diffraction near the melting point. In all the cases the structure factor looks similar to those of liquid metals such as copper and silver in contrast to mercury, tin, and bismuth which show the small hump or the large asymmetry of the first peak maximum in the structure factor. The atomic radial distribution function was evaluated from the structure factor and the interatomic distance and coordination number of each liquid metal were also obtained. The effective interionic potential was derived from the structural data obtained in this work using the Born-Green equation and applied to the estimation of self-diffusion coefficient and viscosity coefficient in these liquid metals by the kinetic theory of fluids. (auth)

9844 INFLUENCE OF THE CATION DISTRIBUTION ON THE MAGNETIZATION OF Y-TYPE HEXAGONAL FERRITES. Albanese, G.; Carbucicchio, M.; Deriu, A. (Parma Univ. (Italy). Instituto di Fisica); Asti, G.; Rinaldi, S. (Consiglio Nazionale delle Ricerche, Parma (Italy). Lab. MASPEC). Appl. Phys.; 7: No. 3, 227-238(Jul 1975).

Moessbauer absorption and magnetization measurements have been made in Mg_2-Y and Co_2-Y ferrites. The magnetizations of the various iron sublattices did not show any marked difference in Mg_2-Y, while in the case of Co_2-Y three different behaviors of the sublattice magnetizations have been detected. Low-temperature magnetization measurements in Mg_2Y gave evidence of a noncollinear magnetic order. The different magnetic properties of these compounds have been explained on the grounds of a preferential occupation by Mg^{2+} and Co^{2+} ions of the inner octahedral sites of the T crystallographic block. The presence in these sites of a non-magnetic ion such as Mg^{2+} is responsible for the peculiar magnetic order observed in Mg_2-Y. (GE)

9845 NEW THEORY FOR MAGNETIC ANISOTROPY IN THE HEAVY RARE EARTH METALS. Eagles, D. M. (National Measurement Lab., Sydney (Australia)). Z. Phys., B; 21: No. 2, 177-184(Jun 1975).

A theory of bandwidth anisotropy in metallic ferromagnets developed previously is specialized to the case of 5d electrons in a hexagonal close-packed lattice. This theory is combined with a model 5d electrons in the heavy rare earth metals to give a new theory for the low temperature values of the magnetic anisotropy coefficients in Tb, Dy, Ho, Er and Tm. (auth)

9846 MANGANESE STEELS IN CRUSHING AND GRINDING SERVICE. Fabert, H. A. Jr. (Abex Corp., Chicago Heights, IL). Met. Eng. Q.; 15: No. 4, 29-33(Nov 1975).

From symposium on materials for the mining industry, Vail, CO (30 Jul 1974).

This is a review of austenitic Mn steels used in gouging, crushing, impact, and grinding wear applications. Their alloyed grades generally use Cr or Mo as alloying additives, and their mechanical properties are charted. Laboratory gouging wear tests are summarized. Material selection is discussed. (DLC)

9847 STEEL GRINDING MEDIA IN PRODUCTION USE. Nass, D. E. (Reserve Mining Co., Silver Bay, MN). Met. Eng. Q.; 15: No. 4, 33-41(Nov 1975).

From symposium on materials for the mining industry; Vail, CO (30 Jul 1974).

This paper reviews the types of steel being used for grinding rods and balls by the mining industry in U. S. and Canada. Results of a Dec. 1973 grinding media survey of U. S. and Canadian mills are summarized. Common alloying elements (C, Mn, Cr, Mo, Cu, etc.) are discussed. Grinding balls and rods are discussed separately; wear tests using irradiated balls are described. Finally, defects in grinding media are discussed. (DLC)

9848 EFFECTS OF RESIDUAL ELEMENTS ON CREEP PROPERTIES OF FERRITIC STEELS. Viswanathan, R. (Westinghouse Electric Corp., Pittsburg). Met. Eng. Q.; 15: No. 4, 50-56(Nov 1975).

The effect of residual elements on the creep and stress rupture properties of Cr-Mo and Cr-Mo-V steels was investigated in two separate studies. In one study, the effects of controlled additions of Sb, P, Sn, and B on the properties of a normalized and tempered Cr-Mo steel at 1000°F were evaluated. In a second study, two commercial Cr-Mo-V steels containing different amounts of Sb, P, Sn, and Al were comparatively evaluated at 950°F and 1100°F. In the Cr-Mo steels, the creep and rupture properties remained unaffected due to large additions of Sb, P, and Sn, but were affected by the presence of boron. Among the Cr-Mo-V steels, the steel containing the higher level of impurities had markedly lower levels of rupture ductility and was severely notch sensitive. A critical review of present results, as well as other pertinent results from the literature, shows that synergistic interactions may exist between the impurities and other variables such as the microstructure, strength level, test temperature, and alloy composition. Further studies of the interactions are needed before a generalized understanding of impurity effects can be developed. 3 tables, 11 figures. (auth)

9849 NEW CAST AIR-MELTABLE HIGH STRENGTH STEELS. Floreen, S. (International Nickel Co., Inc., Suffern, NY). Met. Eng. Q.; 15: No. 4, 56-60(Nov 1975).

This paper describes development of two maraging steels that can be air melted and sand cast. One alloy has been optimized for a 230 ksi yield strength level, and possesses a plane strain fracture toughness (K/sub Ic/) value on the order of 95 ksi root in. in sand castings 1 in. thick. A second alloy was developed to give a yield strength of 180 ksi. In a 6 in. thick air melted sand casting, a yield strength of 189 ksi and a K/sub Ic/ of 118 ksi root in. were obtained. The alloys should be economical, cost-effective materials for many design requirements. (auth)

9850 TUNGSTEN NEWS, NOVEMBER 1975. Tungsten News; 1-30(Nov 1975).

Research and development activities in W technology are reviewed. Information is included on W metal, refractory W compounds for tool materials, W base alloys, W as an additive to alloys, recovery and processing of W, and chemical properties of W compounds. 302 references. (JRD)

9851 MAGNETIC SUSCEPTIBILITY OF Au:Dy DILUTE ALLOYS. Chelkowski, A. (Inst. Fizyki, Uniwersytet Slaski, Katowice, Poland); Orbach, R. Phys. Rev., B; 12: No. 1, 208-210 (1 Jul 1975).

The magnetic susceptibility of dilute Au:Dy alloys has been measured from 1.55 to 300°K for Dy concentrations of 14,200, 7100, 2800, and 1300 ppM. The apparent Weiss constant varies from -1.8°K to zero, within experimental error, over the concentration range. A least-squares fit to the susceptibility data results in a $GAMMA_7$ ground doublet at the two higher concentrations (as reported by Murani for a 15,000-ppM sample), and in a $GAMMA_8$/sup (1)/ ground quartet at the two lower concentrations, the latter in agreement with (500-1000 ppM) EPR data. The dilute-limit crystalline-field parameters C_4 equals -24.8°K, C_6 equals 3.61°K were extracted from the fit to the susceptibility data. (auth)

9852 TILTED-FIELD RADIO-FREQUENCY SIZE EFFECT IN TUNGSTEN. Baer, D. R. (Cornell Univ., Ithaca, NY). Phys. Rev., B; 12: No. 8, 3046-3053(15 Oct 1975).

The radio-frequency size effect (RFSE) was studied in tungsten plates in a magnetic field inclined at an angle to the sample surface using a transmission method. A parametrized model of the tungsten Fermi surface and the geometric model of the RFSE was combined to allow calculation of expected signal positions. Most of the well-defined experimental signals are identifiable using the model and there is general agreement between the experimental data and the calculated signal locations. The relation of the tilted-field RFSE signals to Gantmakher–Kaner oscillations is also discussed. (auth)

9853 ELECTRONIC STRUCTURE OF HCP TRANSITION METALS. Jepsen, O. (AEK Research Establishment, Riso, Denmark); Anderson, O. K.; Mackintosh, A. R. Phys. Rev., B; 12: No. 8, 3084-3103(15 Oct 1975).

Using the linear muffin-tin-orbital method described in the previous paper (Phys. Rev. B 12: 3060), the electronic structures of the hcp transition metals, Zr, Hf, Ru, and Os were calculated. It is shown how the band structures of these metals may be synthesized from sp and d bands, and the effects of hybridization, relativistic band shifts, and spin–orbit coupling are illustrated by the example of Os. By making use of parameters derived from the muffin-tin potential, trends in the positions and widths of the energy bands, especially the d bands, are discussed as a function of the location in the periodic table. The densities of states of the four metals are presented and the calculated heat capacities compared with experiment. The Fermi surfaces of both Ru and Os are found to be in excellent quantitative agreement with de Haas–van Alphen measurements, indicating that the calculated d-band position is misplaced by less than 10 mRy. Very small pieces of Fermi surface, which have not yet been observed experimentally, are predicted for Os. The limited amount of experimental information available for Zr can be fairly satisfactorily interpreted if the calculated d bands are raised by about 10–20 mRy relative to the sp bands. This gives rise to a

Fermi surface which is topologically equivalent to that recently found in Ti, and which does not support open orbits when the magnetic field is sufficiently great that breakdown is complete. It is suggested that the Fermi surface of Hf is probably similar, although very little experimental evidence is available for this metal. Some comments are made about the calculational method, which has proved to be physically transparent, accurate and extremely fast, and the adequancy of the standard potential, which has now been successfully employed in calculations on the great majority of the transition metals. (auth)

9854 MAGNETIZATION CURVES OF SUPERCONDUCTING NIOBIUM. (Nanking Univ., China). Wu Li Hsueh Pao; 24: No. 4, 307-308(Jul 1975). (In Chinese)

The application of an electronic integration technique to the recording of magnetization curves of two Chinese-made pure niobium material samples is reported. After calculating the scales of the x and y axis, three magnetization curves were obtained which give the critical field values H_{c1} of 1.44 and 1.21, and H_{c2} of 2.83 and 3.10 kilo-oersted for samples No. 1 and No. 2 respectively. The error is 1% for x axis and 3% for y axis respectively. The effect of residual magnetization is found to be negligible. (JPRS)

9855 SINGLE-CRYSTAL ELASTIC CONSTANTS OF Zr_2Ni. Eshelman, F.R.; Smith, J.F. (Ames Laboratory, United States Energy Resources Development Administration and Department of Materials Science, Iowa State University, Ames, Iowa 50010). J. Appl. Phys. 46: No. 12, 5080-5083 (Dec 1975).

The ultrasonic pulse-echo-overlap technique has been used to determine the six independent elastic constants of tetragonal Zr_2Ni over the temperature range 4.2–300 K. The temperature dependence of the shear constants, particularly C_{66}, are atypical and indicate a significant degree of mode softening at low temperatures. The results correlate with the recent calculation of Sinha and Harmon in that Zr_2Ni satisfies their conditions for the development of charge density waves with attendant mode softening and support the view that mode softening and superconductivity are correlated. (auth)

9856 STRUCTURE OF NIOBIUM SINGLE CRYSTALS DEFORMED IN THE NORMAL AND SUPERCONDUCTING STATES. Gindin, I.A.; Starodubov, Ya.D.; Aksenov, V.K. (Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov). Sov. Phys.—Solid State 17: No. 4, 648-649 (Apr 1975).

The structure of niobium single crystals ($R_{20°K}/R_{300°K} \simeq 2 \cdot 10^{-2}$) deformed by 2.2% in compression at 4.2 °K in the normal and superconducting states has been studied by light and electron microscopy. The normal state was created by a constant magnetic field. It is shown that mechanical twins are formed more easily in the normal state, though their growth is less rapid as compared with the superconducting state. The density of full dislocations and also the uniformity of slip are somewhat higher in the superconducting state. Possible reasons for the observed difference are discussed. (auth)

9857 LOW-TEMPERATURE CONDUCTIVITY OF STRONGLY COMPENSATED *n*-TYPE InSb. Yaremenko, N.G. (Institute of Radio Engineering and Electronics, Academy of Sciences of the USSR, Fryazino). Sov. Phys.—Semicond. 9: No. 5, 554-558 (May 1975).

An investigation was made of the electrical conductivity and Hall effect in strongly compensated *n*-type InSb. The investigation was carried out in the temperature range 4.5–200°K and a comparison was made with the theory of conduction in heavily doped and strongly compensated semiconductors. The temperature dependence of the conductivity had three exponential regions, which were attributed to the ionization of a deep donor level, activation of electrons from drops to the percolation level, and activated hopping conduction. At lower temperatures the conductivity obeyed the Mott law. An investigation of the nonohmic hopping conduction yielded the density of states in the tail near the Fermi level. A good agreement with the theory was obtained. (auth)

9858 CURRENT–VOLTAGE CHARACTERISTIC OF COMPENSATED *n*-TYPE InSb ANALYZED ALLOWING FOR THE SCATTERING OF ELECTRONS BY OPTICAL PHONONS. Gulyaev, Yu.V.; Chusov, I.I.; Yaremenko, N.G. (Institute of Radio Engineering and Electronics, Academy of Sciences of the USSR, Moscow). Sov. Phys.—Semicond. 9: No. 5, 599-603 (May 1975).

A detailed analysis is made of the current–voltage characteristic of compensated *n*-type InSb allowing for the scattering of electrons by polar optical phonons. It is shown that when the electron temperature is $T > T^*$ ($T^* \simeq 18$°K), the electron energy in *n*-type InSb is dissipated mainly by the interaction with optical phonons and the power transferred from electrons to the lattice rises strongly. This restricts the possibilities of rapid heating of electrons in an electric field and their escape from the percolation level, which is the main nonlinearity mechanism of heavily doped compensated semiconductors. Consequently, the *S*-type region in the characteristic should be much weaker than that predicted theoretically. If at temperature $T > T^*$ the activated conduction (activation energy ϵ_1) along the percolation level predominates over the hopping mechanism, the dependence of the conductivity on the electric field after the "breakdown" should obey a power law with an exponent $2\epsilon_1/(\hbar\omega_0 - \epsilon_1)$, where $\hbar\omega_0$ is the energy of longitudinal optical phonons. These conclusions are in good agreement with the experimental data for *n*-type InSb with a high degree of compensation $0.9 \lesssim K \lesssim 0.999$. If $K \lesssim 0.999$, the observed nonlinearity of the current-voltage characteristic can be explained by the nonohmic hopping conduction. (auth)

9859 OPTICAL PROPERTIES OF THE *W*-27 at.% Re ALLOY. Kirillova, M.M.; Nomerovannaya, L.V.; Noskov, M.M. Opt. Spectrosc. (USSR) 39: No. 1, 61-63 (July 1975).

A polarimetric method was used to measure the refractive index n and absorption coefficient k of the *W*-27 at.% Re alloy at 295 K ($\lambda = 0.3$–16 μm) and 77 K ($\lambda = 1$–6 μm). The dispersion of the interband absorption was analyzed, and the general structure of the electronic energy spectrum is shown to be retained when tungsten forms an alloy with 27 at.% Re. However, significant changes occur in the region of the spectrum adjacent to E_F ($\Delta E \simeq 0.8$ eV), with corresponding changes in electronic characteristics. The interband conductivity of the alloy was determined experimentally from optical measurements and is shown to have a complicated form that includes characteristic absorption features of both components of the alloy. (auth)

9860 GENERALIZED PHONON-CONNECTED RELATIONS IN THE HALL RESISTIVITY OF CADMIUM. Gerritsen, A.N. (Physics Department, Purdue University, West Lafayette, Indiana 47907). Phys. Rev. B 12: No. 10, 4247-4254 (15 Nov 1975).

An analysis of Hall resistivity data for Cd and Cd-alloy crystals previously published by Lilly and Gerritsen has led to the following, rather unexpected results. The coefficient (A_1) of the term in first order in H, the magnetic field parallel to the hexagonal axis, varies as $A_1 \propto \rho_{11}^{-1} e^{-43/T}$ in the temperature range $8 \leq T \leq 200$ K (ρ_{11} is the resistivity parallel to ⟨1120⟩). The difference between the measured Hall resistivity and $A_1 H$ passes zero for all samples at $T \simeq 11$ K. This temperature can be connected to the onset of strong, specific phonon modes. A further relation, that may have less physical significance is that in the temperature range $10 < T < 20$ K, where the Hall resistivity passes through a maximum, the field H_m at the maximum varies as $H_m \propto \rho_{11}^{-1} e^{-109/T_m}$. The temperature 109 K compares to the temperature $\Theta_R = 112$ K that has to be used in the Bloch-Grüneisen relation to describe ρ_{11} (T) for temperature above ≃8 K. (auth)

9861 THEORY OF THE GALVANOMAGNETIC PROPERTIES OF CADMIUM IN THE TEMPERATURE RANGE 10–40 °K. Hsu, W.Y.; Falicov, L.M. (Department of Physics, University of California, Berkeley, California 94720). Phys. Rev. B 12: No. 10, 4255-4260 (15 Nov 1975).

A simple model that involves the contribution to the relaxation time of an Einstein-like phonon mode is proposed to explain recently observed puzzling features in the galvanomagnetic properties of cadmium in the temperature range from 10 to 40 °K. Anisotropic scattering effects are also discussed. (auth)

9862 TEMPERATURE AND COMPOSITIONAL DEPENDENCE OF MAGNETIC BUBBLE PROPERTIES OF AMORPHOUS Gd-Co-Mo FILMS. Hasegawa, R. (IBM Thomas J. Watson Research Center, Yorktown Heights, New York 10598). J. Appl. Phys. 46: No. 12, 5263-5267 (Dec 1975).

It is shown that the temperature and compositional dependence of the magnetic bubble properties of amorphous Gd-Co-Mo sputtered films can be described satisfactorily by simple models based on mean field analysis of the experimental data. Using the fitting parameters obtained, bubble properties such as $4\pi M_s$, l, Q, and H_c (collapse field) are predicted as a function of temperature for 1-, 0.5-, and 0.25-μm-diam bubbles. Optimum compositions for small temperature derivatives are suggested by this analysis. Some consideration of the dynamic properties for the present ternary films is also given. (auth)

9863 DE HAAS–VAN ALPHEN EFFECT AND THE BAND STRUCTURE OF URh_3. Arko, A.J.; Brodsky, M.B.; Crabtree, G.W.; Karim, D.; Koelling, D.D.; Windmiller, L.R. (Argonne National Laboratory, Argonne, Illinois 60439); Ketterson, J.B. Phys. Rev. B 12: No. 10, 4102-4112 (15 Nov 1975).

We have performed measurements of the de Haas–van Alphen (dHvA) effect in the intermetallic compound URh_3, a material with a partially filled 5*f* shell. Complex dHvA spectra containing several frequencies were observed and Fourier analyzed with an on-line computer. Effective-mass measurements were made for several orbits and values as large as 5.3 were observed. Much of the data are consistent with a multiply connected surface whose shape is discussed. In addition to the dHvA experiments, a detailed band-structure calculation was performed using the nonflat relativistic-augmented-plane-wave formalism. The Fermi surface deduced from these calculations is in qualitative agreement with the experimental observation. (auth)

9864 ELECTRICAL RESISTIVITY OF BERYLLIUM. Mitchell, M.A. (Naval Surface Weapons Center, White Oak Laboratory, Silver

Spring, Maryland 20910). J. Appl. Phys. 46: No. 11, 4742-4746 (Nov 1975).

Measurements have been made of the electrical resistivity of two single crystals of beryllium parallel and perpendicular to the hexagonal c axis, respectively, between 4 and 800 °K. The resistance ratios were 10.0 and 15.5 for the parallel and perpendicular directions, respectively. The anisotropy of the temperature-dependent part of the resistivity was about 35% ($\rho_{\parallel}$ being higher) at room temperature in contrast to 12% found by Grüneisen and Erfling. The anisotropy was approximately constant in temperature above 273 °K and decreased rapidly below. The Bloch-Grüneisen equation was fit to the data. The characteristic temperatures were $\theta_R = 1246 \pm 1$ and 1202 ± 1 °K for the parallel and perpendicular directions, respectively. (auth)

9865 MICROSTRUCTURE AND FLUX PINNING IN COMMERCIAL Nb-25% Zr SUPERCONDUCTING WIRES. Santhanam, A.T.; Moon, D.M.; Mathur, M.P.; Ashkin, M.; Deis, D.W. (Westinghouse Research Laboratories, Pittsburgh, Pennsylvania 15235). J. Appl. Phys. 46: No. 11, 4951-4956 (Nov 1975).

A detailed structural examination was carried out on commerical Nb-25% Zr conductors which had been heavily cold worked and annealed in the temperature range 600–700 °C for times ranging from 1/4 to 10 h. The magnetization of some of these wires had previously been measured (Mathur *et al.*) as a function of applied magnetic field at temperatures ranging from 4.2 °K to the transition temperature and the results were interpreted in terms of a flux-pinning model proposed by Kramer. Additional magnetization measurements on larger-diameter wires were made to aid in the interpretation of the flux-pinning mechanisms. Transmission electron microscopy, x-ray analysis, and hardness measurements revealed that the predominant structural change in the annealed wires was recovery of dislocation structure. No β_{Zr} or α_{Zr} precipitates were detected. It is concluded that the optimum flux-pinning properties in Nb-25% Zr conductors for the processing schedules studied are associated with a highly recovered and small dislocation cell structure. (auth)

9866 MAGNETIC PROPERTIES OF THE $ThCo_{5-x}Ni_x$ SYSTEM. Narasimhan, K.S.V.L.; Do-Dinh, C.; Wallace, W.E. (Department of Chemistry, University of Pittsburgh, Pittsburgh, Pennsylvania, 15260); Hutchens, R.D. J. Appl. Phys. 46: No. 11, 4961-4964 (Nov 1975).

Magnetic moments, Curie temperatures, and anisotropy fields are presented for $ThCo_{5-x}Ni_x$ ternaries for temperatures ranging from 4.2 to 300 K. $ThNi_5$ is a Pauli paramagnet. The Co moment in $ThCo_5$ is 1.16 μ_B per atom. The reduction below 1.7 μ_B for elemental cobalt is ascribed to electron transfer from Th to Co together with shifts in the relative positions of the cobalt 3*d* subbands. The variation of anisotropy field with composition supports the notion that the magnetic anisotropy of $ThCo_5$ originates largely with Co in the 2(*c*) sites. The coercive force, measured at 4.2 K, increases with nickel content attaining a value of 20 kOe for $ThCo_{3.5}Ni_{1.5}$. This alloy has at 4.2 K an energy product of 2.6 MG Oe. (auth)

9867 IMPROVED COMPOSITE-PROCESSED V_3Ga THROUGH PARTIAL SUBSTITUTION OF ALUMINUM FOR GALLIUM IN THE MATRIX. Yoshida, Y.; Tachikawa, K. (National Research Institute for Metals, 2-3-12, Nakameguro, Meguro-ku, Tokyo, Japan); Iwasa, Y. Appl. Phys. Lett. 27: No. 11, 632-634 (1 Dec 1975).

The effects of the partial substitution of aluminum for gallium in the matrix on the superconducting properties of composite-processed V_3Ga have been investigated. At an aluminum concentration of 2–3% there is considerable increase in J_c and a slight increase in H_{c2}. (auth)

9868 SPARKLIKE DOMAIN PATTERN AND HYSTERESIS LOOPS OF AMORPHOUS Gd-Fe ALLOY FILMS. Imamura, N.; Mimura, Y.; Kobayashi, T. (KDD Research and Development Laboratory, Nakameguro, Meguro-ku, Tokyo, Japan). Appl. Phys. Lett. 27: No. 11, 634-636 (1 Dec 1975).

We studied the domain structure and the hysteresis loop of amorphous Gd_xFe_{1-x} alloy films having perpendicular easy axis anisotropy, and found that the domain pattern, just after reversal at the nucleation field, was sparklike where the strip domain diverged radially from one point to all the area of the sample. The nucleation field H_n was strongly dependent on the maximum magnetizing field H_m for $H_m < 2$ kOe. In the region $H_m > 2$ kOe, however, the value of H_n was almost constant at 450 Oe. (auth)

9869 STUDIES ON THE ELECTRONIC STRUCTURE OF SOME CUBIC INTERMETALLIC COMPOUNDS OF DYSPROSIUM FOLLOWING THE SELF-CONSISTENT AUGMENTED-PLANE-WAVE METHOD. Belakhovsky, M. (Centre d'Etudes Nucléaires de Grenoble, B.P. 85, 38041 Grenoble Cedex, France Ray, D. K. Phys. Rev. B 12: No. 9, 3956-3963 (1 Nov 1975).

The energy bands and the nature of the conduction electrons have been studied for two intermetallic compounds of dysprosium, i.e, DyZn and DyRh, following the self-consistent augmented-plane-wave (APW) method. The convergence of energy was found to be rapid for DyZn because the shell of $3d^{10}$ electrons for Zn lies below the conduction band. The Fermi energies (E_F) have been calculated to be 0.421 and 0.477 Ry for DyZn and DyRh, respectively. The densities and the numbers of conduction electrons inside and outside the APW spheres in each of these compounds are calculated, and it is shown that the character of conduction electrons inside the APW sphere of Dy is predominantly of *d* type. In order to see the accuracy of these results, self-consistent calculations were done for DyZn for different choices of the exchange potentials, and the calculated number of conduction electrons did not change significantly. The consequence of the predominance of *d* electrons in the conduction band on the various physical parameters is discussed. (auth)

9870 DOPED EuTe: A MIXED MAGNETIC SYSTEM. Vitins, J.; Wachter, P. (Laboratorium für Festkörperphysik, Eidgenössische, Technische Hochschule, 8049 Zürich, Hönggerberg, Switzerland). Phys. Rev. B 12: No. 9, 3829-3839 (1 Nov 1975).

The additional magnetic exchange introduced by doping of the magnetically ordering Eu chalcogenides has been investigated in the case of antiferromagnetic EuTe by means of the Faraday rotation, optical absorption, reflectivity measurements, luminescence, and photoconductivity. The magnetic contributions due to the electrons which were introduced by doping could always be well distinguished by comparison with measurements on undoped samples. Our results lead to the conclusion that at least in the nondegenerate EuTe the introduced electrons form large spin dressed particles, namely magnetic polarons or at low temperatures ferromagnetic spin clusters which can extend over as many as 2000 Eu ions. The size of these clusters and their degree of magnetic order is, however, dependent on temperature, applied magnetic field, and on the concentration of dopant. The existence of these spin clusters was verified by the observation of domain patterns with a polarizing microscope. Novel also is our discovery of a very large wavelength-independent Faraday rotation, which reaches values of up to 3600 deg/cm at 4.2 K. We have attributed this Faraday rotation to magnetic resonance of the spin clusters in the exchange fields of the magnetic sublattices. (auth)

9871 SUPERCONDUCTING CRITICAL FIELDS IN NIOBIUM AND NIOBIUM CONTAINING OXYGEN. Kirschenbaum, J. (Department of Physics, Queens College of the City University of New York, Flushing, New York 11367). Phys. Rev. B 12: No. 9, 3690-3696 (1 Nov 1975).

In situ resistive measurements of the ratio of surface to bulk critical fields in thoroughly degassed pure niobium foils are found to agree well with theory over the temperature range $0.69 \leqslant t \leqslant 0.99$. This result is unchanged after reheating the samples above 2000 K, in oxygen atmospheres of up to 0.96×10^{-7} Torr. We have also observed a considerable increase in H_{c3} and H_{c2} in samples reheated at above 0.96×10^{-7} Torr, with the Ginzburg-Landau parameter κ rising to 3.04 after reheating at 5.0×10^{-7} Torr. Nonetheless, the ratio of critical fields remains 1.7 to $t = 0.97$. The increased critical fields can be attributed to increased surface roughness and faceting which occurs on heating in oxygen, resulting in a considerably diminished mean free path. An enhancement of H_{c3} above the value $1.7H_{c2}$ was observed above $t = 0.97$ in these samples. The cause of this behavior has yet to be understood, although we suggest the presence of carbides at the surface as an explanation. (auth)

9872 CALORIMETRY AUTOMATION IN THE 0.4–3 K RANGE: USE OF THE NBS SUPERCONDUCTIVE FIXED POINT DEVICE AND THE SPECIFIC HEAT OF COPPER. Martin, D.L. (Division of Physics, National Research Council of Canada, Ottawa, Canada). Rev. Sci. Instrum. 46: No. 12, 1670-1675 (Dec 1975).

Operation of an automatic data acquisition system, with an on-line minicomputer, in the 0.4–3 K temperature range is described and illustrated by results obtained on pure copper. The temperature scale was set up using both ^{3}He vapor pressure thermometry and the NBS superconductive fixed point device. On the basis of specific heat measurements on pure Cu and Cu alloys, it appears that the temperatures assigned by the NBS to the superconducting transition temperatures of cadmium and zinc are too close. The required adjustment is within their assigned uncertainty limits. (auth)

9873 MAGNETIC SMALL-ANGLE SCATTERING OF SUB-THERMAL NEUTRONS BY INTERNAL STRESS FIELDS IN WORK-HARDENED NICKEL SINGLE CRYSTALS ORIENTED FOR MULTIPLE GLIDE. I. Experiments and Results. Vorbrugg, W.; Schaerpf, O. (Technische Univ., Brunswick). Philos. Mag.; No. 3, 629-641(Sep 1975). (In German).

The small-angle scattering of Ni single crystals with (111) and (100) axis orientation is measured by a photographic method in the work-hardened state after tensile deformation. Parameters are the external magnetic field H parallel to the axis ($600 \leq H[Oe] \leq 1000$), the plastic shear stress τ_{pl} ($1.4 \leq \tau_{pl}[kp/mm^2] \leq 8.8$), and the elastic stress τ_{el} ($0 \leq \tau_{el} \leq \tau_{pl}$) applied to the deformed crystals during the experiments. The scattering is found to be anisotropic and characteristic for the chosen orientation. The quantitative photometric analysis shows that the parameters mentioned above only influence the intensity but not the distribution of the scattered neutrons. The scattering increases with the elastic stress and decreases with the magnetic field. In

particular, in the unloaded state there is a linear relation between the scattered intensity and the plastic shear stress. (auth)

9874 MAGNETIC SMALL-ANGLE SCATTERING OF SUB-THERMAL NEUTRONS BY INTERNAL STRESS FIELDS IN WORK-HARDENED NICKEL SINGLE CRYSTALS ORIENTED FOR MULTIPLE GLIDE. II. Theory and Quantitative Evaluation. Vorbrugg, W. (Technische Univ., Brunswick). Philos. Mag.; 32: No. 3, 643-662(Sep 1975). (In German)

Taking account of the experiments described in Part I the theory of the magnetic scattering of unpolarized neutrons in work-hardened single crystals is extended to crystals oriented for multiple glide considering the magnetic anisotropy energy, the external elastic stresses, and the eigenstresses of dislocations with finite length. The quantitative evaluation of the measurements is strictly based on the structure of the dislocation network as revealed by TEM. The distribution of the scattered neutrons can only be explained in a satisfactory way if coherent scattering from regions with high stress concentrations extending along the glide planes is regarded as the basic mechanism. For a simple description of these regions two models are proposed, first a disk model with homogeneous deviation of the magnetization and second a pile-up model. They both yield the local distribution of the scattering in quantitative agreement with the experiments. Furthermore, the pile-up model is able to explain the magnetic field dependence of scattering and to give information about the dislocation density α from the increase of the intensity with the plastic shear stress τ_{pl}. In particular, a relation $\alpha \sim \tau_{pl}^2$ is shown to be in accordance with EM results. The influence of elastic tensile stresses on the scattering can be reduced quantitatively to equivalent changes of the magnetic field indicating that there is no essential rearrangement of the dislocation network in the loaded state. (auth)

9875 DIFFUSION OF ^{60}Co IN VANADIUM SINGLE CRYSTALS. Pelleg, J. (Israel Atomic Energy Commission, Beersheba). Philos. Mag.; 32: No. 3, 593-598(Oct 1975).

The diffusion of ^{60}Co in vanadium single crystals was measured over the temperature range 1025 to 1853°C. No change in slope of the Arrhenius curve was found, such as has been reported for vanadium self-diffusion, and the curve was linear. It seems that one single diffusion mechanism is operative through the entire temperature range. The data can be fitted to the relation $D = \{1.12^{+0.5}_{-0.3}\} \exp[(70451 \pm 1049)/RT]$. (auth)

9876 MEASUREMENT OF THE LATTICE THERMAL CONDUCTIVITY OF TUNGSTEN BY TWO INDEPENDENT METHODS. Fletcher, R. (Queen's Univ., Kingston, Ont.). Philos. Mag.; 32: No. 3, 565-576(Sep 1975).

Results of experimental measurements are presented of tungsten lattice thermal conductivity in the ^{4}He range by two independent methods. The methods are, one, the standard technique of evaluating the limiting high-field value of the thermal conductivity and, two, the use of the Righi-Leduc and Hall coefficients. The results of the two methods do not agree. It is suggested that the extreme non-equilibrium distribution of the electronic system may be responsible for the discrepancy. (auth)

9877 DISLOCATION MECHANISMS FOR PLASTIC FLOW OF NICKEL IN THE TEMPERATURE RANGE 4.2-1200K. Sastry, D. H.; Tangri, K. (Univ. of Manitoba, Winnipeg). Philos. Mag.; 32: No. 3, 513-525(Sep 1975).

The temperature ranges of thermal and athermal deformation behavior of nickel are identified by employing the temperature-dependence of flow-stress and strain-rate cycling data. The results are used to present a unified view of dislocation mechanisms of glide encompassing the two thermally activated and the intermediate athermal regimes of plastic flow. In the low-temperature thermally activated region (<250°K) the strain rate is found to be controlled by the repulsive intersection of glide and forest dislocations, in accordance with current ideas. The athermal stress in this region can be attributed mainly to the presence of strong attractive junctions which are overcome by means of Orowan bowing, a small contribution also coming from the elastic interactions between dislocations. The values of activation area and activation energy obtained in the high-temperature region (>750°K) negate the operation of a diffusion-controlled mechanism. Instead, the data support a thermal activation model involving unzipping of the attractive junctions. The internal (long-range) stress contribution here results solely from the elastic interactions between dislocations. This view concerning the high-temperature plastic flow is further supported by the observation that the Cottrell-Stokes law is obeyed over large strains in the range 750 to 1200°K. (auth)

9878 ATOMIC-VOLUME DEVIATIONS AND OCCURRENCE OF ATOMIC MAGNETIC MOMENTS IN TRANSITION METALS AND THEIR ALLOYS. Chapnik, I. M. (Technion-Israel Inst. of Tech., Haifa). Philos. Mag.; 32: No. 3, 673-681(Sep 1975).

Deviations of the atomic volume from additivity are determined for binary compounds of non-magnetic transition metals (components with close group numbers), for compounds of the latter with Be and Mg, and for alloys of Gd, Mn, U, and Np with transition and non-transition metals. In most compounds of non-magnetic transition metals (except those of U and Np) the deviation does not exceed 3%. The abnormally large negative deviation in γ-La, δ-Mn, γ-U, γ-Np, U_2Ru_3, URe_2, $NpRe_2$, Os_3Ta, and $BeMo_3$ is probably related to occurrence of ferro- or antiferromagnetism in these phases. (auth)

9879 EFFECT OF MAGNETIC TRANSFORMATION ON STACKING FAULT ENERGY OF NICKEL BINARY ALLOYS. Ishida, K. (Daido Steel Co. Ltd., Minami, Japan). Philos. Mag.; 32: No. 3, 663-669(Sep 1975).

The stacking fault energy of nickel-base alloys is estimated by thermodynamic analysis. It is shown that magnetic surface energy makes a more significant contribution to stacking fault energy than the difference in bulk free energies between the fcc and hcp phases. It is also demonstrated that the effect of alloying elements on the stacking fault energy of nickel corresponds closely with the variation of Curie temperature. (auth)

9880 SODIUM–LITHIUM PHASE DIAGRAM: REDETERMINATION OF THE LIQUID IMMISCIBILITY SYSTEM BY RESISTANCE MEASUREMENT. Down, M. G.; Hubberstey, P.; Pulham, R. J. (Univ. of Nottingham, Eng.). J. Chem. Soc. (London), Dalton Trans.; No. 14, 1490-1492(1975).

The sodium-lithium phase diagram was determined over the entire composition range by a combination of resistance and thermal methods. Each method is especially effective for specific parts of the phase diagram, two liquid phases separate below 305 ± 1°C; this temperature is variously reported between 303 and 442°C in the literature. The consolute composition is 63 mol % Li. The immiscibility boundary extends from 10.1 to 97.0 mol % Li at the monotectic temperature 170.75 ± 0.05°C. A eutectic occurs at 3.0 mol % Li and 92.10 ± 0.05°C. Positive deviation from ideality has been observed for both sodium- and lithium-rich solutions. (auth)

9881 MAGNETIC PROPERTIES, MAGNETIC STRUCTURE OF GdMg AND TbMg COMPOUNDS. Aleonard, R.; Morin, P.; Pierre, J.; Schmitt, D. (CNRS, Grenoble, France). Solid State Commun.; 17: No. 5, 599-603(1 Sep 1975).

The magnetic properties of GdMg and TbMg, as well as the magnetic structure of TbMg, have been investigated by neutron diffraction. Both compounds have a non-colinear magnetic structure with a ferromagnetic component. In GdMg, the spontaneous magnetization reaches $4.54\mu_B$ at 4.2°K and decreases as T^2. For TbMg at 4.2°K, the ferromagnetic component and the antiferromagnetic component perpendicular to the propagation vector ($\frac{1}{2}$ 0 0) are nearly equal to $5.17\mu_B$. (auth)

9882 DE HASS-VAN ALPHEN STUDIES OF THE FERMI SURFACE OF α-URANIUM. Schirber, J. E. (Sandia Labs., Albuquerque, NM); Arko, A. J.; Fisher, E. S. Solid State Commun.; 17: No. 5, 553-556(1 Sep 1975).

The low temperature phase changes in α-uranium have been suppressed with hydrostatic pressures ≥8.3kbar. Observation of the de Haas-van Alphen effect under these conditions permits measurement of Fermi surface cross sections and their pressure derivatives. This constitutes the first result of this kind in an actinide metal with a partially filled 5f band. (auth)

9883 MICROSTRUCTURE AND TOUGHNESS OF STRUCTURAL STEELS. Chipperfield, C. G.; Knott, J. F. (Cambridge Univ., Eng.). Met. Technol.; 2: No. 2, 45-51(Feb 1975).

The effects of notch acuity, inclusion content, and strength level on the toughness of a variety of ductile steels have been investigated in fully plastic single edge notched bend testpieces. Results for specimens containing fatigue precracks and sharp notches indicate that accurate predictions of a material's resistance to the initiation of fibrous fracture ahead of a fatigue crack may be inferred from tests on notched testpieces and from a knowledge of the microstructure of the material; an experimental procedure has been proposed whereby this may be achieved for quality control and material evaluation purposes. The spacing of optically visible inclusions is found essentially to define both the unit of ductile crack extension and, for low-strength steels, the limiting lateral dimensions of the high-strain field ahead of the crack tip. As a consequence, the notch-tip ductility is found to be invariant with the changes in notch acuity for sharp stress concentrators. The effect of increasing the purity and/or strength level is to alter the mechanism of fibrous fracture from one involving void growth and coalescence to one of predominantly shear character. (auth)

9884 HARTREE–FOCK RENORMALIZATION OF MAGNETIC ANISOTROPY IN THE BASAL-PLANE FERROMAGNETS TERBIUM AND DYSPROSIUM. Jensen, J. (Oxford Univ.). J. Phys., C (London); 8: No. 17, 2769-2780(7 Sep 1975).

It is shown that the application of the Holstein–Primakoff transformation in the spin-wave theory of an anisotropic ferromagnet implies contributions from the isotropic two-ion coupling to the energy of the uniform spin-wave mode. Including these contributions, the energies of the HF renormalized spin waves are deduced using the method of Lindgard and Danielsen (Phys. Rev.; B 11: 351(1975)). The macroscopic resonance theory for the uniform mode is found to agree with the spin-wave theory if the magnetization is along a symmetry direction. Numerical results for the renormalization of the static anisotropy parameters of Tb and Dy are presented. The effect of the ellipticity of the moment precession is found to be smaller than reported previously. (auth)

9885 STUDIES OF ALLOY 800 IN HTR HELIUM BY THE DRAGON PROJECT. Betteridge, W.; Bates, H. G. A. (Organization for Economic Co. Operation and Development, Winfrith, Eng.). pp 170-183 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British nuclear energy society conference; Reading, England (25 Sep 1974).

Several heats of Alloy 800 are included in a survey of materials being creep tested in a simulated HTR helium atmosphere in the temperature range 650 to 800°C. Preliminary results indicate wide variations in the influence of the atmosphere on creep properties. Some heats appear, for up to 10,000 h, to have greater creep strength in helium than in air, but others have the strength reduced by as much as 20%. Metallographic examination of terminated creep test bars and of unstressed samples indicates that oxidation of reactive constituents takes place, forming a surface scale and subsurface oxide penetration. Carburisation can also occur and at 750 to 800°C this can penetrate to a depth of up to 800 μm after 5000 h. (auth)

9886 OPTIMIZATION OF INCOLOY ALLOY 800 MECHANICAL PROPERTIES FOR VARIOUS POWER PLANT REQUIREMENTS. Moeller, R. H.; Martin, J. M. (International Nickel Co., Inc., New York). pp 199-217 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British nuclear energy society conference; Reading, England (25 Sep 1974).

The ASME Boiler Code development of design stresses and their optimization for alloys 800 and 800H for conventional and nuclear power plants have coincided with many successful trial installations of these grades of alloy 800. These trial installations, along with laboratory tests, have shown that alloy 800H can be used for long times with a retention of good mechanical properties, including ductility. While gamma prime can be formed, it soon loses its detrimental effect on ductility in service. Sensitization of alloy also occurs but it, too, has a decreasing effect on corrosion resistance with time in service, especially at elevated temperatures. The paper discusses all of these aspects and it is concluded that alloy 800 perhaps with low carbon control in the annealed (982 to 1066°C) condition gives the optimum combination of properties to 566°C and alloy 800H (0.05 to 0.10% C) solution annealed at 1149 to 1204°C has optimum properties above 566°C. Effects of Al and Ti and the benefit of keeping these within the ASTM limits of 0.15 to 0.60% are also stressed. (auth)

9887 ALLOY 800 MECHANICAL PROPERTIES DATA AND DESIGN CODE REQUIREMENTS. Wood, D. S. (United Kingdom Atomic Energy Authority, Risley, Eng.). pp 219-233 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British nuclear energy society conference; Reading, England (25 Sep 1974).

Mechanical property data needs are considered in terms of design code requirements for nuclear applications in the UK. Two situations are considered, one being a high-carbon Grade 2 alloy for HTR applications, and the other being a low-carbon Grade 1 alloy for CFR applications. It is shown that, although most data exist for the Grade 2 alloy which is coded in ASME Code Case 1952, a number of areas require further study before this alloy can be specified with confidence for HTR applications. These areas include the more extensive provision of combined creep/high strain fatigue data, a study of factors affecting the creep rupture ductility and evaluation of the effect of environment on the mechanical properties. In the case of low-carbon Grade 1 material, an extensive data collection program would be necessary in the temperature range 500 to 550°C before the properties of this alloy could be reliably specified for CFR application. (auth)

9888 DESIGN DATA. Egnell, L. (Sandvik AB, Sweden). pp 235-240 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British nuclear energy society conference; Reading, England (25 Sep 1974).

Though several mechanical property aspects are considered in a comprehensive design procedure for Alloy 800 in nuclear power applications, it is mainly the proof stresses in the lower temperature range and the creep-rupture strength at higher temperatures that set the limits for primary membrane stresses. The cross-over temperature occurs between 500 and 600°C, the exact position of which depends especially on the heat treatment of the material. In the proof stress range, the simple fact applies that a lower heat treatment temperature, e.g. for a cold-reduced tube, gives a higher proof stress and consequently also a higher design stress. In the creep range, the situation is the reverse and thus a higher heat treatment temperature gives higher strength. The heat treatment and also the chemical composition are then efficient means to influence design data. However, they cannot be applied unrestrictedly but have to be balanced against requirements on corrosion resistance and creep-rupture ductility. This fact has been recognized in the present discussions on Alloy 800 specifications for HTR and LMFBR boiler and superheater tubes. In the following comments are given on the situation regarding the creep-rupture properties as determined in tests run with Sandvik's corresponding Sanicro materials. (auth)

9889 FACTORS INFLUENCING THE CREEP BEHAVIOR OF ALLOY 800. Asbury, F. E.; Willoughby, G. (Central Electricity Research Labs., Leatherhead, Eng.). pp 242-250 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British nuclear energy society conference; Reading, England (25 Sep 1974).

Studies were made of the stability of the creep behavior of two commercial casts of Incoloy 800, one high carbon and the other low carbon. Effects of pre-aging, of prolonged creep up to 10^4 hours duration, and of grain size were investigated. Three factors were found to exercise a major influence on creep behavior. First, when the high carbon alloy was heat treated at 1150°C super-saturation effects, ascribed principally to carbon, gave some initial strengthening which would not, however, persist for the duration of service life in nuclear power plant applications above 600°C. Secondly, a gamma-dash type phase precipitated readily at 550 to 600°C, giving a marked increase in creep strength. Nucleation was sluggish at higher temperatures but once established, this form of strengthening could persist up to at least 650°C. Creep under nonisothermal conditions at 600 to 700°C would be complex on account of the behavior of this phase. The hardening associated with its precipitation was greater in the low carbon alloy. Finally it was demonstrated that, in spite of gamma-dash precipitation, fine-grained low carbon material was weak in creep at low stresses and temperatures. This was ascribed to the occurrence of grain boundary diffusion creep. It appears that this source of weakening would persist in service and severely restrict the maximum temperature of usage for fine-grained high tensile material. (auth)

9890 EFFECT OF TITANIUM AND ALUMINIUM ON HIGH TEMPERATURE PROPERTIES. Orr, J. (British Steel Corp., Rotherham, Eng.). pp 267-272 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British nuclear energy society conference; Reading, England (25 Sep 1974).

The paper presented by Stone, Guest and Orr earlier in the conference (The Status of Alloy 800, 1974) dealt in some detail with the basic metallurgy of Alloy 800. The purpose of the present contribution is to expand on some of the points raised, and in particular to show the effect of Ti and Al on the properties of this alloy through their influence on age hardening behavior. It has already been indicated that when the carbon content is 0.03% or lower, a significant proportion of the total Ti is retained in solution after cooling from solution treatment temperatures. It is this Ti, and also Al, which then precipitates as $Ni_3(Al, Ti)$ during reheating at 600 to 700°C causing age-hardening and hence influencing the high-temperature properties. The precipitate is basically that of Ni_3Al but Ti has a significant effect, because up to 60% of the aluminium can be replaced by Ti without any significant alteration to the fcc lattice structure. Figures are presented to show how higher (Ti + Al) levels increase stress rupture strength, decrease rupture ductility, and cause some decrease in notched rupture strength. A summary of the effects of precipitation on rupture ductility over a wide range of temperatures is given. A figure is also presented to show the improvement in ductility at 700°C obtained by reducing only the Al content, but with some loss of strength. (UK)

9891 CREEP AND FATIGUE OF ALLOY 800 IN HELIUM. Cook, R. H. (Central Electricity Research Labs., Leatherhead, Eng.). pp 150-169 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British nuclear energy society conference; Reading, England (25 Sep 1974).

Proposals for use of Alloy 800 as a HTR boiler material have prompted studies of its creep and high-temperature fatigue properties in impure helium with comparative tests in air. In impure helium, as expected in a HTR, reactions of potential importance are selective oxidation (of Cr, Al and Ti) and possibly carburization from carbon monoxide or methane. In air, general oxidation will occur, possibly accompanied by nitridation. The effects of these reactions will depend on specimen geometry and the nature of the deformation. Two important possibilities are: (i) that environment affects the structure and properties of a surface zone of material undergoing uniform deformation (this may modify creep rate and crack nucleation); and (ii) that environment affects behavior of a small region (e.g. at the root of a notch or ahead of a crack) in a specimen undergoing non-uniform deformation (this will modify crack growth and hence rupture life or fatigue endurance). This paper summarizes experimental work demonstrating an influence of the above reactions on mechanical properties of austenitic steels and nickel-based alloys, drawing examples where possible from the limited data available on Alloy 800. While nitridation and carburization may simply increase creep resistance at the expense of ductility (and possibly of fatigue resistance), the effects of oxidation are complex. At high oxygen pressures (as in air) oxygen may reduce creep and fatigue resistance by promoting cavitation but formation of oxide in cracks can reduce their propagation rate. At low oxygen pressures, as expected in HTR helium, oxygen-enhanced cavitation is less likely, but selective oxidation along grain boundaries can sometimes assist crack nucleation. (auth)

9892 THERMAL CONDUCTIVITY STANDARD REFERENCE MATERIALS: PROGRESS REPORT. Hust, J. G. (National Bureau of Standards, Boulder, CO). pp 22-25 of Advances in Thermal Conductivity. Reisbig, R. L. (ed.). Rolla, MO; Univ. of Missouri (1974).

From 13th international conference on thermal conductivity; Lake Ozark, Missouri, USA (5 Nov 1973). See CONF-731106-.

New characterization data for SRM 734 (electrolytic Fe) and SRM 735 (austenitic stainless steel) are discussed. Thermal and electric conductivity data are tabulated for sintered tungsten at 10 to 250°K. (DLC)

9893 COOPERATIVE MEASUREMENTS OF HEAT TRANSPORT PROPERTIES OF TUNGSTEN, ALUMINA, AND POLYCRYSTALLINE GRAPHITE UP TO 2700°K. Fitzer, E.; Weisenburger, S. (Institut fuer Chemische Technik, Karlsruhe, Ger.). pp 42-56 of Advances in Thermal Conductivity. Reisbig, R. L. (ed.). Rolla, MO; Univ. of Missouri (1974).

From 13th international conference on thermal conductivity; Lake Ozark, Missouri, USA (5 Nov 1973). See CONF-731106-.

Thermal diffusivity and conductivity data are presented for arc-cast tungsten, alumina, and polycrystalline graphite. Extrapolation of the low-temperature data into the high-temperature range is discussed. (DLC)

9894 REINFORCED SUPERCONDUCTORS FOR CTR (TOKAMAK) MAGNET. Moss, M.; Gerstle, F. P. Jr. (Sandia Labs., Albuquerque, NM). pp 10-15 of Materials Review '75. Azusa, CA; Society for the Advancement of Material and Process Engineering (1975).

From 7th national SAMPE technical conference; Albuquerque, New Mexico, USA (14 Oct 1975). See CONF-751005-(Suppl.).

Superconducting wire composed of Nb-Ti filaments in a copper stabilizing matrix (1:1.25 by volume) was mechanically reinforced with diffusion-bonded Borsic-Al tape brazed to the copper. The elastic modulus and tensile strength of the composite are higher than those of the superconducting wire alone enabling it to better withstand the high stresses in the magnet winding of a Tokamak thermonuclear reactor. (auth)

Radiation Effects

Refer also to abstracts 9188, 9993, 10232, 10247, 10600, 11245, 11304, 11382, and 11383.

9895 (BLG-508, pp 99-105) POST-IRRADIATION MECHANICAL PROPERTIES OF BR2 IRRADIATED CLADDING MATERIALS (MOL-1 AND MOL-3). Boehm, H. (Kernforschungszentrum, Karlsruhe, Ger.). 1973.

From symposium dealing with research and development work on the liquid metal cooled fast breeder reactor, the gas-cooled reactor and the water cooled reactor; Mol, Belgium (4 Dec 1973).

In results of five years of BR2 reactor utilization.

A survey is given of the experiment series Mol-1 and Mol-3 and of the results of the post-irradiation examinations. Mol-1 is an irradiation test carried out on tensile specimen in simple capsules up to about 80°C and a fast fluence of about 5×10^{21} n.cm^{-2}. Mol-3 consists of tests on sheet metal samples at well-defined temperatures above 600°C and a fast fluence of about 1×10^{22} n.cm^{-2}, with the main objective of measuring high temperature embrittlement. Data are given for 1.4988 and 1.4970 austenitic steels. (auth)

9896 (BLG-508, pp 107-112) IRRADIATION PROGRAM AND RESULTS CONCERNING IN-PILE CREEP AND STRESS-RUPTURE STRENGTH BEHAVIOR OF CANNING MATERIALS (MOL-2 AND MOL-5). Closs, D. (Kernforschungszentrum, Karlsruhe, Ger.). 1973.

From symposium dealing with research and development work on the liquid metal cooled fast breeder reactor, the gas-cooled reactor and the water cooled reactor; Mol, Belgium (4 Dec 1973).

In results of five years of BR2 reactor utilization.

A survey is given of the main objectives and results of irradiation experiment series Mol-2 and Mol-5. Mol-2 serves for studying the in-pile creep and stress-rupture strength behavior of tube specimens under internal pressure at high temperature; Mol-5 is used for studying the creep characteristics of sheet specimens under unaxial-stress, up to a fast fluence of about $1.9.10^{21}$ n.cm^{-2}. (auth)

9897 (CONF-751006-21) X-RAY STUDIES OF IRRADIATION INDUCED DISLOCATION LOOPS IN METALS. Larson, B. C. (Oak Ridge National Lab., Tenn. (USA)). 1975. 10p. Dep. NTIS $4.50.

From international conference on radiation damage in metals; Gatlinburg, Tennessee, USA (5 Oct 1975).

Theoretical and experimental progress has resulted in the increased use of x-rays for the study of defects and defect clusters in crystals. An outline of the theoretical framework associated with Huang, Stokes-Wilson and integral diffuse scattering from dislocation loops is presented, and an account of recent experiments on radiation induced loops is given. These studies include low temperature, ambient temperature, and elevated temperature irradiations of metals with electrons, neutrons, and accelerated ions, and pertain to the study of the thermal annealing characteristics as well as the as-produced damage structure. The information obtained by x-rays as to the type, size and concentrations of dislocation loops is contrasted with existing electron microscopy, electrical resistivity, and lattice parameter data in order to establish correlations and identify areas of disagreement. (auth)

9898 TIME-DIFFERENTIAL OBSERVATION OF QUADRUPOLE INTERACTIONS, FOLLOWING RECOIL IMPLANTATION OF A Ge-PROBE INTO Cd, In, Sn, and Sb. Bartsch, W.; Leitz, W.; Mahnke, H. E.; Semmler, W.; Sielemann, R.; Wichert, T. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F.R. Germany). Bereich Kern- und Strahlenphysik; Freie Univ. Berlin (F.R. Germany). Fachbereich Physik). Z. Phys., B; 21: No. 2, 131-134(Jun 1975).

The quadrupole interactions of excited ^{67}Ge nuclei in the polyvalent metals Cd, In, Sn, and Sb were measured. The experiments have been performed by the time-differential angular distribution technique, following the reaction ^{64}Zn(α,n)^{67}Ge to produce and implant the Ge nuclei into the different metals (DIMPAD). A sandwich target system is used, which allows the application of the DIMPAD-technique for low recoil energies. The extracted electric field gradients are found to depend on the host metal as well as on the solute Ge. An interpretation is suggested on the basis of charge screening effects. (auth)

9899 MASS SPECTROMETRY OF IONS EMITTED FROM A SOLID AREA UNDER ELECTRON BOMBARDMENT. Staerk, M. (Tuebingen Univ. (F.R. Germany). Inst. fuer Angewandte Physik). Optik; 36: 139-155(1972). (In German).

The substance of a small region 20 μm in diameter on a solid surface is evaporated, and part of it singly or multiply ionized using an electron beam at a power density of 10^6 Watt/cm^2 (U = 100 kV, I = 10 μA) and a cross section diameter of 10 μm. The ions are accelerated by a highly stabilized tension ($\Delta U/U < 10^{-4}$) of 12 kV, and separated according to their charge-mass-ratio in a constant magnetic field ($\Delta B/B < 10^{-4}$). The spectra of Mg, Zn, Cd, CdO, $CdCl_2$ and $(CF_2)n$ contain simply and multiply ionized particles, in the case of Cd up to 9 times. The energy width within the ion beam thus produced is certainly below 20 eV, and the mass resolution A = M/ΔM exceeds 200. (auth)

9900 DISLOCATION LOOPS WITH A ≤ 100 ≥ BURGERS VECTOR PRODUCED BY MeV ELECTRON IRRADIATION IN FCC COPPER–NICKEL. Leffers, T. (Danish Atomic Energy Commission, Risoe); Barlow, P. Philos. Mag.; 32: No. 2, 491-496(Aug 1975).

Dislocation loops with Burgers vector a(100) are formed in Cu–Ni alloys during 1-MeV electron irradiation in a high-voltage electron microscope at 350–400°C. The dislocation loops are of interstitial type and pure edge in character with (110) line vectors. Some of the loops are seen to dissociate into loops with Burgers vector a/2(110). (auth)

9901 I_D-I_E RECOVERY IN ELECTRON IRRADIATED COPPER. I. Experimental. Parkin, D. M.; Thompson, L.; Sosin, A. (Univ. of Utah, Salt Lake City). Radiat. Eff.; 25: No. 4, 217-232(Aug 1975).

The I_D-I_E region (30 to 60°K) was studied using sequential isothermals following irradiation near 4.2°K, as a function of electron energy, E_e, and initial defect concentration, C_i. Resistivity was monitored almost continuously, and end point measurements were made at 4.2°K to correct for deviations from Matthiessen's rule. Using temperature-compensated (equivalent) annealing times, obtained with the factor $\exp\{-[(0.117 \pm 0.003\ eV)/kT]\}$, isothermal sections were joined to yield densely populated extended recovery profiles. The recovery is strongly E_e-dependent for $E_e \sim 0.5$ MeV, only slightly between 0.6 and 1.4 MeV. The E_e-dependence is consistent with a model in which i-v pairs of large separations are produced in or near ⟨110⟩ directions. I_D is independent of C_i. The C_i-dependence of I_E requires i-i and i-impurity interactions. A three-dimensional model is fit to the 0.6-MeV data at 2, 7, and 25 ppM point defect concentration, using a Gaussian separation distribution having a mean separation of 1.6 capture radii. (auth)

9902 I_D-I_E RECOVERY IN ELECTRON IRRADIATED COPPER. II. Theory. Thompson, L.; Sosin, A. (Univ. of Utah, Salt Lake City). Radiat. Eff.; 25: No. 4, 233-252(Aug 1975).

A complete diffusional analysis of the low temperature, I_D-I_E post-irradiation recovery stages in copper is presented. In applying this analysis to experiments, intrinsic defect characteristics are deduced by multi-parameter, minimum deviation fitting. The vacancy capture radius for interstitials is found to be 3.2 ± 0.3 lattice constants, for example. In addition, the shape of the initial interstitial–vacancy separation distribution function was determined. A single distribution function describes this distribution for irradiation by electrons with energies greater than 0.6 MeV. At lower energies, the function is narrowed. (auth)

9903 ANALYSIS OF THE RECOVERY OF DILUTE ALLOYS OF GOLD AND SILVER IN COPPER AFTER LOW-TEMPERATURE ELECTRON IRRADIATION. Cannon, C. P.; Sosin, A. (Univ. of Utah, Salt Lake City). Radiat. Eff.; 25: No. 4, 253-269(Aug 1975).

The influence of dilute concentrations of both Au and Ag atoms on the stage I and stage II annealing structure in copper was investigated using electrical resistivity measurements. An excellent agreement of the Stage I_d and I_e experimental data with the theoretical predictions of the Simpson–Sosin full diffusional theory is obtained; this analysis determines the capture radius of solute Au atoms in Cu to be 1.7 ± 0.1 l.c. and that of solute Ag atoms in Cu to be 1.8 ± 0.1 l.c. (in comparison with an interstitial-vacancy capture radius of 3.2 l.c.). Four well-defined recovery substages are observed in the dilute alloys during stage II recovery. An interpretation of each of these substages, consistent with experimental results, is presented. The following processes were observed to occur during stage II: the release of trapped interstitial atoms from trapping centers formed by the proximity of a gold atom near a vacancy; the rearrangement of trapped interstitials to new trapping positions at impurity atoms; and the thermal activation of trapped interstitials from doublet impurity atoms as well as from single impurity atoms. (auth)

9904 SURFACE DENUDATION OF VOIDS INDUCED BY 200 keV C^+ ION. Shimada, M.; Nakahigashi, S.; Terasawa, M. (Tokyo Shibaura Electric Co., Ltd.). Radiat. Eff.; 25: No. 4, 283-285(Aug 1975).

Measurements are reported of the surface denudation of voids induced in solution-treated type 304 stainless steel, in the irradiation temperature range of 450 to 775°C, with 200-keV C^+ ions. The influence of helium atoms, which were pre-injected with the same accelerator at room temperature, was also studied. The specimens were examined using a JSEM-200 electron microscope. A curve is presented showing the width of the surface denuded zone as a function of irradiation temperature. The relation between void diameter and its distance from the irradiated specimen surface is also shown. (UK)

9905 CHANGES IN POSITRON ANNIHILATION CHARACTERISTICS IN MOLYBDENUM INDUCED BY NEUTRON IRRADIATION. Petersen, K.; Knudsen, M.; Cotterill, R. M. J. (Danmarks Tekniske Hoejskole, Lyngby). Philos. Mag.; 32: No. 2, 417-426 (Aug 1975).

Positron annihilation was used in a study of the annealing of molybdenum samples irradiated at 60°C to doses of 2.16×10^{18} and 10.6×10^{18} fast neutrons/cm², and at 110°C to a dose of 2.11×10^{18} fast neutrons/cm². Isochronal annealing of these samples produced changes in the positron characteristics from which it was possible to identify the defect mechanisms involved in the different annealing stages and their dependency on irradiation conditions. (auth)

9906 VOID FORMATION DURING ANNEALING OF NEUTRON-IRRADIATED MOLYBDENUM. Petersen, K. (Danmarks Tekniske Hoejskole, Lyngby); Evans, J. H.; Cotterill, R. M. J. Philos. Mag.; 32: No. 2, 427-430(Aug 1975).

Examination by transmission electron microscopy of molybdenum specimens neutron-irradiated at 60°C with doses of 2.16×10^{18} and 10.6×10^{18} fast neutrons cm^{-2} revealed the presence of voids with diameters up to 60 Å. This observation corroborates earlier conclusions based on positron annihilation measurements. (auth)

9907 HOPPING CONDUCTIVITY OF *n*-TYPE GERMANIUM IRRADIATED WITH Co^{60} γ RAYS. Dobrego, V.P.; Ermolaev, O.P. (V. I. Lenin Belorussian State University, Minsk). Sov. Phys.–Semicond. 9: No. 5, 606-607 (May 1975).

The influence of γ irradiation on arsenic- or antimony-doped germanium was investigated in the temperature range 2–4°K by measuring the electrical properties. The results were analyzed using the hopping conduction theories of Miller and Abrahams, and of Shlovskii and Efros. It was concluded that the modern theories describe only partly the dependence of the hopping conductivity on the degree of compensation. (auth)

9908 INFLUENCE OF IRRADIATION TEMPERATURE ON THE AMORPHIZATION OF SILICON BY ION BOMBARDMENT. Baranova, E.K.; Gusev, V.M.; Khaibullin, I.B. (I. V. Kurchatov Institute of Atomic Energy, Moscow). Sov. Phys.–Semicond. 9: No. 5, 630-631 (May 1975).

Further results are reported on the amorphization of silicon due to heavy ion irradiation. The absorption coefficient is determined for bombardment by B^{11}, C^{12}, Ne^{20}, Ar^{40}, and Sb^{121} at 40 keV. (AIP)

9909 *In situ* DEVICES FOR THE MEASUREMENT OF ANELASTIC EFFECTS UNDER NEUTRON IRRADIATION. Masson, M.; Warlop, R.; Bisogni, E.; Halbwachs, M. (Centre d'Etudes Nucléaires de Grenoble, B.P. 85, Centre de Tri, 38041 Grenoble Cedex, France). Rev. Sci. Instrum. 46: No. 12, 1685-1688 (Dec 1975).

Two devices for the direct measurement of the anelastic properties of metals in a reactor are described. First, a resonant cavity system has been adapted for the in-pile determination of dimensional changes, with application to strain relaxation measurements at and above room temperature. Second, an inverted torsion pendulum operated at 130 Hz at a constant amplitude has been devised for the study of internal friction in metals exposed to a fast neutron flux. The relevant detection systems and the mechanical arrangements for both apparatus are given, together with typical recorded curves. (auth)

9910 ENHANCED DIFFUSION OF Zn IN Al UNDER HIGH-FLUX HEAVY-ION IRRADIATION. Myers, S.M.; Picraux, S.T. (Sandia Laboratories, Albuquerque, New Mexico 87115). J. Appl. Phys. 46: No. 11, 4774-4776 (Nov 1975).

Zinc diffusion in Al has been enhanced by factors $\sim 10^2$-10^6 under 80–keV Ne and 160-keV Ar irradiation at damage rates $\lesssim 1$ dpa/sec (dpa = displacements per atom). The Ne bombardment was varied in flux in the range (1.4–70) $\times 10^{13}$ atoms/cm² sec, and in temperature in the range 50–130 °C. The enhanced diffusion coefficient is linear in Ne flux and nearly independent of temperature, both consistent with annihilation of mobile defects at fixed sites. Analysis indicates that the average diffusion distance to annihilation for mobile defects is ~1000 Å, and that one mobile defect is created for $\sim 10^2$ atomic displacements. (auth)

9911 DEFECT-IMPURITY INTERACTION AND LOSS OF NUCLEAR ALIGNMENT OF ^{69}Ge AND ^{67}Zn IN COPPER METAL. Schatz, G.; Rafailovich, M.H.; Little, W.A.; Sprouse, G.D. (Department of Physics, State University of New York, Stony Brook, New York 11794). Phys. Rev. Lett. 35: No. 16, 1086-1088 (20 Oct 1975).

The alignment of impurity nuclei recoil-implanted into copper has been measured as a function of temperature. At 300 K, ^{69}Ge and ^{67}Ge impurities lose 50% of the nuclear alignment within 10^{-9} sec after implantation into the copper host, while the full alignment is observed for the ^{67}Zn impurity. The temperature dependence of the alignment can be explained by a simple model which assumes static quadrupole interactions with lattice defects in the vicinity of the impurity. (auth)

9912 CRITICAL CURRENT CHANGES IN Nb_3Sn IRRADIATED WITH FAST NEUTRONS AT 6 K. Brown, B.S.; Blewitt, T.H.; Wozniak, D.G. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439); Suenaga, M. J. Appl. Phys. 46: No. 12, 5163-5168 (Dec 1975).

Multifilament copper-clad wires of Nb_3Sn have been irradiated at 6 K to a dose of 1.8×10^{18} n/cm² (E > 0.1 MeV). The critical current (J_c) was measured as a function of dose and applied magnetic field to 33 kOe. After 1.2×10^{18} n/cm², an increase of 33% in J_c occurred at 33

kOe from an initial value of 1.5×10^6 A/cm² at 4.5 K. The increase was smaller at lower applied fields, and J_c actually decreased for $H<8$ kOe. For all fields, the increase in J_c eventually saturated and then decreased as the dose increased, with the saturation dose increasing with increasing applied field. The critical temperature (T_c) changed by <1 K at the highest dose. Approximately 25% of the change in J_c recovered after a 295 K anneal. The J_c changes are explained as an increase in flux pinning from radiation-induced defect cascades that leads to an increase in J_c greater than the decrease in J_c which results from a decrease in T_c of 1 K and from the increase in H_{c2} produced by the increase in normal resistivity. A model is proposed that allows the prediction of the dose dependence of various terms in the pinning-force density and explains the field and dose dependence of the J_c changes. Measurements of the superconducting-to-normal-state thermal transition indicate that the decrease in thermal conductivity of the Cu cladding is important when considering the degradation of the thermal transition current that occurs at high doses. (auth)

9913 A PROPOSED METHOD OF CALCULATING DISPLACEMENT DOSE RATES. Norgett, M. J. (UKAEA Research Group, Harwell, Atomic Energy Research Establishment); Robinson, M. T. (Oak Ridge National Lab., Tenn. (USA)); Torrens, I. M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Section de Recherches de Metallurgie Physique). Nucl. Eng. Des.; 33: No. 1, 50-54(Aug 1975).

A simple procedure is proposed for calculating the number of atomic displacements produced in a damage cascade by a primary knock-on atom of known energy. The formulae have been chosen to give results in close accord with recent computer simulations of radiation damage phenomena. The proposed new standard is compared with other empirical formulae for estimating the number of atomic displacements in a cascade. (NL)

9914 THE CONVERSION OF DISPLACEMENT PRODUCTION TO DEFECT PRODUCTION IN STAINLESS STEEL THROUGH COMPUTER EXPERIMENTS. Doran, D. G. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Nucl. Eng. Des.; 33: No. 1, 55-62(Aug 1975).

There is a growing need to correlate radiation effects data obtained with neutron and charged particles. The exposure unit, displacements per atom, is generally inadequate for this purpose. A description is given of a computer experiment methodology that permits estimation of the numbers and types of residual defects produced by various irradiation environments. Application is made to neutron spectra characteristics of two fast reactors. (NL)

9915 THE CALCULATION OF DISPLACEMENT RATES IN STAINLESS STEEL UNDER NEUTRON AND ELECTRON IRRADIATIONS. Doran, D. G. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Nucl. Eng. Des.; 33: No. 1, 63-77 (Aug 1975).

The calculation of displacement rates in neutron and electron irradiations is reviewed. Comparisons are made of neutron displacement cross sections calculated using several secondary displacement models. Included are comparisons of some spectrum-averaged cross sections for EBR-II and FFTF spectra. The status of electron displacement cross sections is reviewed. An exercise is performed to deduce neutron and electron cross sections consistent with an assumed direction dependent damage energy threshold. It is suggested that neutron-electron damage correlations should be based on free defect cross sections rather than displacement cross sections. (NL)

9916 MIGRATION OF COPPER DIVACANCIES IN THE PRESENCE OF HELIUM. Wilson, W. D.; Bisson, C. L. (Sandia Labs., Livermore, CA). Radiat. Eff.; 25: No. 3, 197-199(1975).

The activation energy for migration of a divacancy in copper has been calculated to be 0.47 eV in a pure copper lattice and 0.74 eV if the divacancy contains a helium atom. The result for the pure divacancy is in reasonable agreement with reported experimental values. The energy required for a helium atom to migrate from one vacancy to the other in a divacancy is found to be 0.18 eV so that the rate-limiting step in the migration of helium in copper via a divacancy mechanism is the movement of the divacancy at 0.74 eV. (auth)

9917 ANISOTROPY OF THE DISPLACEMENT ENERGY IN SINGLE CRYSTALS OF MOLYBDENUM. Maury, F.; Vajda, P.; Biget, M.; Lucasson, A.; Lucasson, P. (CNRS, Orsay, France). Radiat. Eff.; 25: No. 3, 175-185(1975).

A geometrical model for the threshold energy surface of a bcc lattice is applied to analyze recent measurements of the resistivity change rates in electron-irradiated monocrystalline molybdenum specimens with the orientations [100], [110], [111] and [112]. Cross sections computed with this surface were matched to the experimental data using various sets of threshold energies as parameters. The best fit was obtained with $T_d[100] = (35^{+}_{-}4)$ eV, $T_d[110] > 2T_d[100]$, $T_d[111] = (45 \pm 3)$ eV. When compared with the experimental damage rates the absolute values for the cross sections yield a Frenkel pair resistivity $\rho_F^{Mo} = (13 \pm 2)\mu\Omega$cm/at.% F.P. Expressions for the energy necessary to penetrate the potential barriers in the principal crystallographic directions are derived and compared with the $T_d[ijk]$ data obtained before, with the interatomic potential as parameter. Taking into account the length of the [111] collision chains and the size of the spontaneous recombination volume, the appropriate potential can be chosen in the range between $U^{Mo}(r)/eV = 3000\exp(-3.2\ r/\text{Å})$ and $11{,}000\exp(-3.8\ r/\text{Å})$. An analysis of the displacement cross sections made it possible to explain the energy and orientation dependence of stage I recovery and to attribute the sub-stages at 15 and 40°K to the annealing of interstitials due to [100] displacements and the sub-stages between 20 and 33°K to that of [111] chains of various lengths. (auth)

9918 EFFECT OF IRRADIATION TEMPERATURE ON Si AMORPHIZATION PROCESS. Baranova, E. C.; Gusev, V. M.; Martynenko, Y. V.; Haibullin, I. B. (Inst. of Atomic Energy, Moscow). Radiat. Eff.; 25: No. 3, 157-162(1975).

Questions on the amorphization mechanism of semiconductors during ion bombardment have been considered theoretically. The probability of the formation of crystalline disordered regions (CDR) and amorphous regions (AR) has been calculated as a function of irradiation temperature T, atomic number Z_1 and ion energy. It has been shown that the role of CDR in the amorphization process increases with the increase of T and decrease of M_1. The effect of irradiation temperature (T = −150, +25 and +100°C) on the silicon amorphization process during bombardment by light (^{11}B), mean (^{20}Ne) and heavy (^{121}Sb) ions has been studied by various techniques: ir-absorption, ir-reflection and fast electron diffraction. It has been shown that the influence of irradiation temperature is stronger for light ions and large values of T. Theoretical results are in good agreement with experimental ones. (auth)

9919 VOLUME EXPANSION DUE TO SUBSTITUTIONAL AND INTERSTITIAL HELIUM ATOMS IN bcc METALS. Johnson, R. A. (Univ. of Virginia, Charlottesville); Bisson, C. L.; Wilson, W. D. Radiat. Eff.; 25: No. 3, 155-156(1975).

The volume change due to substitutional and interstitial helium atoms in V, Fe, Mo, Ta, and W has been determined using the displacement fields from previously reported model calculations. Interstitial He produces a lattice expansion of less than one atomic volume in all metals studied, ranging from 0.4 to 0.9Ω. The volume change for substitutional He in a given metal is $0.6 \pm 0.1\Omega$ less than that for interstitial He in that same metal. (auth)

9920 ELECTRON ENERGY LOSS ANALYSIS OF ALUMINUM FOILS IRRADIATED WITH ARGON IONS. Ditchfield, R. W.; Whelan, M. J.; Wilson, M. M. (Oxford Univ.). Radiat. Eff.; 25: No. 3, 201-203(1975).

Electrochemically thinned and polished disks of high purity aluminum were irradiated with 60 keV argon ions and were subsequently examined in an energy analyzing electron microscope of the Mollenstedt type. Image features believed to arise from small argon bubbles in the aluminum matrix and argon blisters at the aluminum/oxide interface were observed. The electron energy loss spectrum from the bubbles is in agreement with Natta's theory. (auth)

9921 VARIATIONS IN THERMOELECTRIC POWER AND D.C. RESISTIVITY IN SEQUENTIALLY IRRADIATED AND ANNEALED n- AND p-TYPE DOPED α-TIN. Charles, J. E.; Gardiner, R. B.; Myhra, S. (Queensland Univ., St. Lucia, Australia). Radiat. Eff.; 25: No. 3, 145-154(1975).

Sequential irradiations and anneals were carried out on n- and p-type α-tin filaments. Irradiations were performed at 4.5°K for a nominal electron beam energy of 0.90 MeV. A carrier removal rate varying with defect concentration was found. Isochronal anneals were carried out over the temperature range 20 to 47°K. Four first-order stages with activation energy scaling factors of 67, 90, 106 and 122 MeV were resolved in order of increasing temperature. A fractional defect recovery scheme was deduced with defect concentration ratios given by $I_A: I_B: I_C: I_D = 84:4:6:6$ for the four stages. An average constant carrier removal rate was used to deduce charge carrier mobilities from both damage and annealing data. It was found that the electron mobilities were inconsistent with those deduced from the theory of ionized impurity scattering. A model is proposed requiring that the majority of the defects result in deep acceptor sites. In addition, shallow defect states positioned somewhat above the Γ_7^+ conduction and valence band junction are proposed to account qualitatively for the observed results. (auth)

9922 INSTABILITY OF CRYSTALLINE SOLIDS UNDER IRRADIATION. Martin, G. (CEN, Saclay, France). Philos. Mag.; 32: No. 3, 615-627(Sep 1975). (In French).

The migration of radiation-produced point defects is explicitly taken into account in a chemical rate model, and it is shown that the stationary state of a crystal under irradiation may become unstable with respect to spatial defect concentration fluctuations, provided that the defect generation-rate G is larger than a critical value G^*. G^* is a function of temperature T and of parameters characteristic of the crystal. Once the general formalism is established, the case of a single-component crystal, in which the only defects under consideration are single vacancies and single interstitials, is studied in more detail. From the model an instability limit can be drawn in the $G \times T$ plane. G thus appears to be an intensive variable for crystals under irradiation. This limit is calculated explicitly for nickel. The instability region seems to be in the experimental range. Several consequences of the model are discussed, such as the nucleation of ordered defect arrays, and radiation-induced precipitation in dilute solid solutions which are thermodynamically stable without irradiation. (auth)

9923 A UKAEA EVALUATION OF DISPLACEMENT DAMAGE MODELS FOR IRON. Etherington, E. W.; Bramman, J. I. (UKAEA Reactor Group, Dounreay. Dounreay Experimental Reactor Establishment); Nelson, R. S.; Norgett, M. J. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Nucl. Eng. Des.; 33: No. 1, 82-90(Aug 1975).

Various damage models used within the UKAEA have been evaluated and compared in the context of fast reactor and accelerator irradiations for iron. The limitations of the Kinchin-Pease model are discussed in the light of the present understanding of the partition between elastic and inelastic energy loss within collision cascades. The individual collisions within the cascade are treated as a series of binary collisions and matched to dynamic collision models at low energy. It is recommended that the damage model based on the calculations of Norgett, Robinson and Torrens be used for the calculation of the number of atomic displacements produced during neutron or ion irradiation. (NL)

9924 DAMAGE FUNCTION DATA CORRELATION FOR THE YIELD STRESS OF IRON. Odette, G. R. (California Univ., Santa Barbara (USA)). Nucl. Eng. Des.; 33: No. 1, 37-47(Aug 1975).

The effectiveness of the damage function analysis method of correlating experimental irradiation effects data and predicting material responses in different neutron environments was investigated. Major sources of uncertainty in damage function analysis including the questions of existence, uniqueness and data error propagation were investigated. The semi-empirical damage function and its estimated errors for iron irradiated at about 80°C to fluences of approximately 10^{18}-10^{20} n/cm^2 were analyzed for comparison with other common correlation procedures. The study indicated that damage function analyses can under certain conditions be an effective means of establishing both nominal and lower bound fluence limits for reactor components. (NL)

9925 ENGINEERING DAMAGE CROSS SECTIONS FOR NEUTRON EMBRITTLEMENT OF A302-B PRESSURE VESSEL STEEL. Serpan, C. Z. Jr. (Naval Research Lab., Washington, D. C. (USA)). Nucl. Eng. Des.; 33: No. 1, 19-29(Aug 1975).

Analyses now completed show that more than 94% of the neutron-induced embrittlement in A302-B steel is caused by neutrons of energies >0.1 MeV. Furthermore, application of the analysis techniques permits computation of "damage-fluence" values incorporating damage cross sections and fluence >0.1 MeV that provide the best possible correlation of experimental data regardless of the radiation environment. The technique and cross sections are thought to be sufficiently general that they can be used as a basis for establishing new sets of cross sections for other plates of steel having different chemical composition from that of the original study. (NL)

Other Materials

Refer also to abstracts 8859, 8867, 8871, 8944, 9216, 9360, 9383, 9384, 9395, 9402, 9769, 9867, 9893, 9899, and 10277.

9926 (CEA-CONF-3016) CONDUCTIVITY OF γ-IRRADIATED LiF. Guckelsberger, K.; Neumaier, K. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Transfert et Conversion d'Energie). 1974. 13p. (In German). INIS.

From conference on solid state physics; Freudenstadt, F. R. Germany (1 Apr 1974).

The conductivity of γ-irradiated pure monocrystalline LiF was measured in the temperature range 0.3-100°K. The F centers produced by irradiation disperse phonons and point defects, the corresponding fluorine atoms on interlattice sites appear as clusters of about 10 Å diameter, and high irradiation doses (above 10^9R) give rise to extensive perturbation zones. Each of these 3 defects influences heat conduction in a characteristic temperature range and may thus be analyzed during irradiation and consecutive recovery. (FR)

9927 (SAND-75-8740) THEORY OF DIFFUSION AND TRAPPING OF HYDROGEN AND HELIUM IN METALS, A REVIEW. Wilson, W. D. (Sandia Labs., Livermore, Calif. (USA)). Nov 1975. Contract AT(29-1)-789. 27p. (CONF-751006-23). Dep. NTIS $5.00.

From international conference on radiation damage in metals; Gatlinburg, Tennessee, USA (5 Oct 1975).

The theory of trapping and diffusion of helium and hydrogen in metals is reviewed. The fundamental aspects of the behavior of these particles is emphasized and hence ab initio methods of calculation of interatomic potentials are described. In particular, two-body free-electron and Hartree-Fock calculations for closed shell systems are described and compared for an example case, He–Cu^+. Helium defect aggregates studied using these potentials are reviewed and several previously unreported calculations of helium clustering in tungsten are given. A brief discussion of the quantum nature of the diffusion of light particles is also given. (auth)

9928 DUCTILE FRACTURE CHARACTERISTICS OF GRAPHITE MATERIALS IN PLANE DEFORMATION. Lomakin, E. V.; Zobnin, A. I.; Berezin, A. V. (Moscow State Univ.). Probl. Prochnosti; No. 4, 89-92(Apr 1975). (In Russian)

Isotropic graphites (MPG-6, MPG-8 and V-1) which differ in structure and mechanical properties were tested for ductile fracture by two methods: the method of ductility and an analytic method. It was established that graphite V-1, having a tensile strength significantly less than the other two, does have a critical coefficient of stress intensity approximately the same as MPG-6, i.e., graphites having different tensile strengths can have the same characteristics of crack development resistance. These tests also revealed that linear mechanics of fracture used for high-strength metallic materials are suitable for graphites. (JPRS)

9929 RADIOTRACER SYSTEM FOR ^{119m}Sn USING TIME-INTERVAL ANALYSIS. Hersee, S. D.; McBeth, G. W.; Small, M. B. (Brighton Polytechnic, Eng.). J. Phys., D (London); 8: No. 13, 1600-1614(11 Sep 1975).

The application of time-interval analysis to the detection of the isotope ^{119m}Sn is described. This is thought to be the first time that the technique has been used to detect an isotope with such a short half-life (19 as) and such low energy radiation (< 40 keV). After-pulsing in the photomultiplier is found to be a problem since a high gain is necessary to detect the ^{119m}Sn radiation. In spite of this, the counting system developed will measure ^{119m}Sn activities within the range 3 μCi to 1 pCi. The lower limit corresponds to a mass of 2×10^{-12}g of tin at a specific activity of 400 mCi g^{-1}. In this investigation, tin radiotracer was diffused into tin-doped GaAs substrates under strictly controlled conditions typical of those experienced during growth by liquid-phase epitaxy, and diffusion profiles were measured. (auth)

9930 ESR OF V_k CENTERS IN CsI. Pilloud, J. J.; Jaccard, C. (Neuchatel Univ., Switzerland). Solid State Commun.; 17: No. 7, 907-909(1 Oct 1975).

V_k centers (self-trapped hole I_2^-) were obtained in CsI doped with Tl^+ or Na^+ by x-irradiation at low temperature and studied by ESR. Spin-Hamiltonian parameters were calculated and compared with those obtained for I_2^- in the other alkali iodides, as well as the energy of the forbidden transition $^2\Sigma_u^+ \rightarrow {}^2\Pi_u$ and the s and p components of the fundamental state. (auth)

9931 IONIZATION EFFECTS ON DAMAGE YIELD IN ION IRRADIATION OF SEMICONDUCTORS. Pabst, H. J. (Sussex Univ., Brighton, Eng.). Radiat. Eff.; 25: No. 4, 279-281 (Aug 1975).

Damage due to ionization effects is well established in certain insulators, and has been suspected to play a role in some compound semiconductors. Recently, ionization damage of the Varley type has been suggested for light ion irradiation of silicon, involving inner-shell ionization. This communication reanalyzes the data in the light of some of the criticism which has come forward and to discuss alternative disorder enhancing mechanisms, i.e. some of the possibilities of ionization assisted elastic displacement, lattice instability, and the magnitude of the subthreshold elastic energy transfer in the ionization damage process previously suggested. The radiation damage caused to Si by He^+ ions and by H^+ ions is discussed in particular. (auth)

9932 ELECTRON MICROSCOPE OBSERVATIONS OF PRECIPITATION IN BORON IMPLANTED SILICON. Comer, J. J.; Roosild, S. A. (Air Force Cambridge Research Labs., Hanscom Field, MA). Radiat. Eff.; 25: No. 4, 275-277(Aug 1975).

Although several reports have been published on the annealing behavior of silicon implanted with boron ions as observed by transmission electron microscopy, the maximum temperature studied appears to be 1000°C. A report is presented on the results obtained upon annealing between 1000 to 1300°C. The nature of the defects observed is discussed. (auth)

9933 EVALUATION OF TEMPERATURE STRESSES IN BORON FIBERS. Polyakov, V. A.; Zhigun, I. G. (Inst. of Polymer Mechanics, Riga). Probl. Prochnosti; No. 3, 85-89(Mar 1975). (In Russian)

Thermal stresses in boron fibers were studied for the purpose of establishing the causes of crack formation in them. On the basis of the theory of thermoelasticity the equations are formulated for a boron fiber cylinder having a temperature gradient. Solutions to the equations were obtained using a Minsk-22 computer which showed that the formation of unsteady-state stresses in boron fibers may be one of the causes of crack formation in them. (JPRS)

9934 CYCLIC STRENGTH OF A COMPOSITE REINFORCED WITH TUNGSTEN. Gayduk, V. V.; Morozov, L. V.; Sukhanov, Yu. V. (Machine Building Inst., Kiev). Probl. Prochnosti; No. 3, 106-109(Mar 1975). (In Russian)

A study was made of the cyclic strength of a 1-mm thick E1435 nichrom composite, reinforced with 0.5-mm diameter tungsten wire (grade VA) where the wire fibers made up 24% of the material volume. Mechanical properties (tensile strength) of the matrix, fiber, and composite were 73.0, 260.0 and 88.0 kg/mm^2 respectively. The fatigue life of alloy EI435 without fibers was 10.97×10^6 cycles, whereas the composite sheet only had a life of 3.09×10^6 cycles for a cyclic stress of 25 kg/mm^2. It was assumed that the reason underlying the lower fatigue strength for the composite was the action of residual stresses which formed during material preparation. Metallographs also revealed slip traces in the tested samples. (JPRS)

9935 DISTRIBUTION OF LITHIUM IN SURFACE LAYERS OF NEUTRON IRRADIATED BORON CRYSTALS AND ITS CHANGE FOLLOWING HEAT TREATMENT. Born, E.; Krahl, J.; Loewedey, R. (Technische Univ. Muenchen (F.R. Germany). Inst. fuer Mineralogie). Atomkernenergie; 26: No. 1, 58-60 (1975). (In German)

The lithium distribution of neutron irradiated boron crystals shows a shortage of lithium from the reaction $^{10}B(n,\alpha)^7Li$ in the superficial parts of the crystal of approximately 2 to 3 μm thickness due to lithium release implied by the kinetic energy of the nucleated Li atoms. In deeper regions the lithium concentration corresponds to the concentration of absorbed neutrons. A heat treatment (470°C, 2.5 h) implies a well-measurable diffusion of lithium along the concentration gradient and to the very surface where lithium is enriched. (auth)

9936 EXCHANGE ENHANCEMENT OF Co^{2+} TRANSITIONS DUE TO RADIATION DEFECTS. Lee, K. H.; Sibley, W. A. (Oklahoma State Univ., Stillwater). Phys. Rev., B; 12: No. 8, 3392-3399(15 Oct 1975).

A study of the radiation-induced impurity optical transitions in $KMgF_3$ crystals was made. It is found that the enhanced oscillator strength of the defect centers is predominately due to exchange. The data indicate that most of the transitions are due to perturbed Mn^{2+} and Co^{2+} transitions. Investigation of the effects of radiation temperature, optical bleaching, and annealing on the optical properties of $KMgF_3$:Mn^{2+} indicates that two types of defects are involved. One is a F-center–Mn^{2+} defect and the other is tentatively identified as an interstitial–F-center–Mn^{2+} defect. 11 figures (auth)

9937 MECHANISM OF THE THERMALLY STIMULATED CONDUCTIVITY OF SILICON IRRADIATED WITH FAST ELECTRONS. Tkachev, V.D.; Yanchenko, A.M. (V. I. Lenin Belorussian State University). Sov. Phys.–Semicond. 9: No. 5, 582-584 (May 1975).

An analysis was made of the thermally stimulated conductivity (TSC), temperature dependence of the steady-state impurity photoconductivity, and photoconductivity kinetics exhibited by n- and p-type silicon after irradiation with 10 and 30 MeV electrons. The main TSC maximum was attributed to the gradual emptying of electron traps ($E_c-0.17$ eV), responsible for the rise of the conductivity, and of hole traps ($E_v+0.45$ eV), responsible for the quenching of the photoconductivity. The nature and recombination characteristics of these traps were considered. (auth)

9938 STRUCTURE OF SURFACE LAYERS OF SILICON HEAVILY IMPLANTED WITH Ar. Ohdomari, I.; Ikeda, M.; Ohno K.; Itoh, T. (School of Science and Engineering, Waseda University, Nishi-Ohkubo, Shinjuku-ku, Tokyo, Japan). J. Appl. Phys. 46: No. 12, 5065-5068 (Dec 1975).

A new ESR center at $g=2.0029$ which was first observed by Chu *et al.* in silicon implanted with 150-keV argon ions to doses $>10^{17}$ ions/cm^2 has been observed, in addition to an amorphous center, in the course of our investigations of amorphous Si layers damaged by ion implantation, when Ar^+ implantation dose is more than about 10 times the critical dose for amorphization. These heavily argon-implanted layers of silicon were characterized using ESR and ESCA. The structure of these layers was identified using transmission electron microscopy. It is found that the new ESR center in heavily implanted layers is due to amorphous SiC. (auth)

9939 COMMENT ON "EVIDENCE FOR ELECTRONIC STOPPING IN ION IMPLANTATION: SHALLOWER PROFILE OF LIGHTER ISOTOPE ^{10}B IN SI". Vaidyanathan, K.V.; Chatterjee, P.K.; Streetman, B.G. (Coordinated Science Laboratory, and Department of Electrical Engineering, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). Appl. Phys. Lett. 27: No. 12, 648-649 (15 Dec 1975).

A recent paper bases several conclusions regarding electronic and nuclear stopping powers of silicon for implanted boron on a few capacitance-voltage measurements of impurity profiles. We suggest here that the accuracy of *C-V* data is insufficient to distinguish small changes in projected range, and that measurements with better resolution are required. (auth)

9940 OBSERVATION OF DYNAMIC THERMAL PROCESSES INDUCED BY α-PARTICLE IMPACT ON SAPPHIRE. Shepard, K.W.; Lai, W.Y.; Mercereau, J.E. (Low Temperature Physics 63-37, California Institute of Technology, Pasadena, California 91125). J. Appl. Phys. 46: No. 11, 4664-4670 (Nov 1975).

An aluminum thin-film superconducting microstrip was used to measure, in real time, the local temperature perturbation caused by single 6-8-MeV α particles striking a sapphire substrate at about 2 °K. The microstrip monitored temperature changes from a few m °K to a few hundred m °K with a spatial resolution of ~ 5 μ and a time resolution of ~ 3 nsec. Results indicate that the initial energy transfer in the substrate lattice is via a thermal shock wave propagating outward from the point of α impact with a velocity of 3×10^3 m/sec to a distance of 20-40 μ followed by a diffusionlike cooling process which appears to be of a highly nonequilibrium nature. (auth)

9941 DYNAMIC STABILITY AND QUENCHING CURRENTS OF SUPERCONDUCTING MULTIFILAMENTARY COMPOSITES UNDER USUAL COOLING CONDITIONS. Duchateau, J.J.; Turck, B. (Département Saturne, S.E.D.A.P, Cen, Saclay, 91190 Gif-sur-Yvette, France). J. Appl. Phys. 46: No. 11, 4989-4995 (Nov 1975).

Although the filaments in a composite are individually stable against the flux jump, the self-field of the conductor as a whole gives rise to stability problems. The way in which flux penetrates into the composite is determined by the apparent thermal and magnetic diffusivities. If the ratio of these two diffusivities is not small, the flux jumps can be slowed down. Therefore, it is too pessimistic to consider only adiabatic conditions in composites as usual. The differential thermal and electrical equations have been solved in the case of a cylindrical composite, taking into account the particular conditions of cooling. Stability of the composite is only achieved if a criterion more optimistic and realistic than the well-known adiabatic criterion is satisfied. Stability curves may be used to predict the degraded quenching currents of a composite in the presence of the flux jump if the thermal diffusivity and the enthalpy of the medium in contact with the conductor are included. (auth)

9942 DESIGN OF ORGANIC METALS AND SUPERCONDUCTORS. Haddon, R. C. (Australian National Univ., Canberra). Nature (London); 256: No. 5516, 394-396(31 Jul 1975).

A discussion is presented on the potential of odd alternant hydrocarbons (OAHs) in the production of what are termed "organic metals", with particular regard to their superconductivity properties. It is thought that such systems might prove superior to present systems. It is stated that there is evidence for the existence of the "metallic" state in some organic charge transfer salts, with a suggestion of low-temperature superconductivity. The discussion is centered on TTF-TCNQ (tetrathiofulvalenetetracyanoquinodimethane). (UK)

9943 POLYMERIC CONDUCTORS AND SUPERCONDUCTORS. Goodings, E. P. (Imperial Chemical Industries, Ltd., London). Endeavour; 34: No. 123, 123-130(Sep 1975).

The production of electrically conductive polymers which are flexible and capable of being shaped by normal processes is discussed. The relation between the structure of the polymer and its ability to transport electric charge is considered. The main problem is to combine high conductivity with good processability and it is shown that stacked-planar systems are superior to conjugated polymers. Good mechanical properties have yet to be achieved. In some way the rigid pi-bonded systems must be combined with a conventional sigma-bonded polymer without destroying its flexibility and tensile properties. The structure

will contain a radical ion system to provide charge carriers but it is not yet known how to design the polymer structure to give high carrier mobility. Further work is required on organic superconductors in unraveling the relationship between charge carrier mobility and the supermolecular structure of polymers. (UK)

9944 DIELECTRIC FUNCTION OF MICA AND QUARTZ DETERMINED BY ELECTRON ENERGY LOSSES. Buechner, U. (Univ., Hamburg). J. Phys., C (London); 8: No. 17, 2781-2787 (7 Sep 1975).

Electron energy loss measurements have been made up to 40 eV on specimens of several members of the mica group and quartz. By means of a Kramers–Kronig analysis, the dielectric functions ϵ_1 and ϵ_2 were deduced from the energy loss function. The excitations observed in mica and quartz are discussed with respect to the basic crystal structure (SiO_4 tetrahedral) of both materials. (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

9945 (BNWL-B-439) AEROSOL MEASUREMENTS ON A METAL WASTE VOLUME REDUCTION STUDY. Sehmel, G. A.; Schwendiman, L. C.; Lloyd, F. A.; Hodgson, W. H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1975. Contract E(45-1)-1830. 19p. Dep. NTIS $4.00.

Particulates generated in an experiment in which stainless steel scrap was melted by the exothermic reaction between silicon and oxygen were sampled. The objective of the sampling was to characterize the particles in the off-gas stream and to determine the total weight of particles airborne. The objective was only partially achieved since the mass of airborne particles was so large that full-flow sampling was possible only for a short period. The particles were analyzed and found to contain Si, Al, Na, and Ba, with Si representing the greatest component. The aerosol was characterized by being typically condensed fume with primary particles of submicron sizes. (auth)

9946 OTHER CONSIDERATIONS IN ESTABLISHING STANDARDS. Gamertsfeler, C. C. (Directorate of Regulatory Standards, Washington, DC). Health Phys.; 29: No. 4, 563-568(Oct 1975).

From proceedings of the second Los Alamos life sciences symposium; Los Alamos, NM, USA (22 May 1974).

The process of identifying as low as practicable guidelines on the release of radioactive material from nuclear facilities involves developing a thorough understanding of the capabilities and costs of potential radwaste systems, the definition of the quantities and kind of radioactive materials which would be expected in the effluents from these systems, as well as a knowledge of the ways these effluents are dispersed in the surface waters and atmosphere around the facility. From this information and a knowledge of the population distribution around the facility and the availability of appropriate dose models, the doses to individuals and the general population can be calculated, and potential risks due to these doses can be estimated. Cost-benefit relationships which identify the costs of population dose reductions and the potential future costs of the doses not eliminated provide a part of the information needed to make the necessary judgments. Other factors include the doses to individuals, the absolute magnitude of the costs, and other less tangible judgmental factors. (auth)

Accountability and Safeguards

Refer also to abstracts 8828, 8832, 8835, and 8845.

9947 SOME STATISTICAL ASPECTS OF BIAS CORRECTIONS. Stewart, K. B. (Battelle Pacific Northwest Labs., Richland, WA). Nucl. Mater. Manage.; 4: No. 2, 20-25(Sum 1975).

An important practical question is whether bias corrections should always be made to a measurement process or should be made only when a test of the measurements of a standard indicates a statistically significant, nonzero bias. Some statistical aspects of this question are studied. Results are expressed in comparative terms, as ratios of mean-square deviations for the two procedures. It is assumed that the standard deviations involved with the measurement process and the standard are known. (auth)

9948 NEW SCOPE AND GOALS FOR N15 SUBCOMMITTEE INMM-9. Bishop, D. M. (General Electric Co., San Jose, CA). Nucl. Mater. Manage.; 4: No. 2, 26-39(Sum 1975).

The current status of ANSI INMM N15 Standards Committee work in the area of nondestructive assay methods for nuclear materials control is summarized. Related ANSI standards development bases and procedures are described. New and expanded scope and goals for N15 Subcommittee INMM-9 (Nondestructive Assay) are presented, including the formulation of five new task forces to develop standards for the use of nondestructive assay methods for nuclear materials control. (auth)

9949 SOME THOUGHTS ON BIAS CORRECTIONS. Jaech, J. L. (Exxon Nuclear Co., Inc., Richland, WA). Nucl. Mater. Manage.; 4: No. 2, 40-44(Sum 1975).

Two key questions on bias corrections in SNM accountability are: (1) when should bias corrections be made, and (2) how may the uncertainty associated with the resulting data be expressed. This paper presents some discussion and results that may be of value in finding answers to these questions. (DLC)

9950 MAKING INFERENCES ABOUT THE SHIPPER'S VARIANCE IN A SHIPPER-RECEIVER DIFFERENCE SITUATION. Jaech, J. L. Nucl. Mater. Manage.; 4: No. 1, 36-38(Spr 1975).

Results are given which will enable the user to determine what statistical procedure to use in certain estimation and hypothesis-testing situations. Two situations are considered: (1) the receiver uses his own value for the measurement variance; (2) he makes inferences about the shipper's variance independent of his knowledge about his own variance. (DLC)

Disposal and Storage

Refer also to abstracts 8994, 8995, 9004, 9776, and 9958.

9951 (SAND-75-5656) SANDIA LABORATORIES ENVIRONMENT AND SAFETY PROGRAMS. Zak, B. D.; McGrath, P. E.; Trauth, C. A. Jr. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 13p. (CONF-750967-8). Dep. NTIS $4.00.

From third ERDA environmental protection conference; Chicago, Illinois, USA (23 Sep 1975).

Sandia, one of ERDA's largest laboratories, is primarily known for its extensive work in the nuclear weapons field. In recent years, however, Sandia's role has expanded to embrace sizeable programs in the energy, resource recovery, and the environment and safety fields. In this latter area, Sandia has programs which address nuclear, fossil fuel, and general environment and safety issues. Here we survey ongoing activities and describe in more detail a a few projects of particular interest. These range from a study of the impact of sealed disposal of radioactive wastes, through reactor safety and fossil fuel plume chemistry, to investigations of the composition and dynamics of the stratosphere. (auth)

9952 DISPOSAL OF RADIOACTIVE WASTES IN SALT DOMES. Gera, F. (Oak Ridge National Lab., TN). Health Phys.; 29: No. 1, 1-7(Jul 1975).

Diapiric salt structures, which are caused by the plastic deformation of thick salt beds, have been proposed as possible locations for the disposal of radioactive wastes requiring long-term containment. There are, however, several important questions concerning tectonic stability, salt dissolution, and reliability of long-term containment that would have to be satisfactorily answered before this scheme of waste disposal could be considered feasible. Several concepts have been proposed for the emplacement of radioactive wastes in diapiric salt structures. The most promising of these are: (1) a mechanical mine, and (2) the mixing of granular waste and crushed salt in deep solution cavities. In comparison with a mechanical mine, the granular mixture in solution cavities would require the mining of larger volume of salt and would be feasible only with wastes aged significantly more than 10 yr; on the other hand, it could offer greater reliability of long-term containment because of the increased isolation provided by the greater depth. (auth)

9953 HANDLING OF HIGHLY RADIOACTIVE WASTE. Netzen, G. ERA (Foeren. Elektr. Ration. Anvaendning); 47: No. 12, 243-244(1974). (In Swedish)

The disposal of highly radioactive waste is not a real problem in Sweden at the present time. Enriched uranium is imported from the U.S.A. and the U.S.S.R. and spent fuel is disposed of to Great Britain and France. With the exploitation of Swedish uranium deposits and the construction of more nuclear power stations it may eventually be necessary to store radioactive waste in Sweden. A committee ("Aka-utredning") is investigating this problem in relation to geological conditions, etc. Special attention is drawn to the PIVER process in France and the use of salt mines in West Germany. (SW)

9954 IMPROVED METHOD FOR STORAGE OF SOLID WASTE. Mecham, W. J. (to U.S. Energy Research and Development Administration). US Patent Application 548,058. Filed date 7 Feb 1975. 7p.

Metal canisters for long-term storage of calcined high-level radioactive wastes can be made self-sealing against a breach in the canister wall by the addition of powdered cement to the canister with the calcine before it is sealed for storage. Any breach in the canister wall will permit entry of water which will mix with the cement and harden to form a concrete patch, thus sealing the opening in the wall of the canister and preventing the release of radioactive material to the cooling water or atmosphere. (auth)

Transportation

9955 (BNL-20538) EVALUATION OF THE HFBR FUEL SHIPPING CASK VERSUS REQUIREMENTS OF ERDAM 0529. Informal Report. Bezler, P.; Milau, J. (Brookhaven National Lab., Upton, N.Y. (USA)). Jul 1974. vp. Dep. NTIS $7.60.

The HFBR Spent Fuel Shipping Cask as modified for shipping longer fuel elements is described in detail and evaluated against ERDAM 0529 standards for packaging; structural integrity under uniform loading or external pressure; criticality; normal transport conditions; hypothetical accident conditions; quality assurance; and operating procedures. (LCL)

9956 (SAND-75-0062) ACCIDENT-RESISTANT CONTAINER: SAFETY FOR WARHEAD TRANSPORT. Executive Summary. Berry, R. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1975. Contract AT(29-1)-789. 21p. Dep. NTIS $4.00.

Development testing of model and full-scale hardware to the abnormal environments created during a cargo aircraft crash has demonstrated that the accident-resistant container (ARC) can protect an enclosed warhead from these abnormal environments. This protection reduces the probability of initiation of the warhead HE. Transfer of the plutonium limit to the ARC may permit transporting increased numbers of warheads on a single transport vehicle. Testing of one warhead configuration has been completed. Production can be initiated for transporting that system in the ARC. Other systems need test evaluation and certification before being transported in the ARC. (auth)

9957 (SAND-75-5986) TECHNOLOGY DEVELOPMENT PROGRAM FOR SAFE SHIPMENT OF SPENT FUEL FROM LIQUID METAL FAST BREEDER REACTOR. Freedman, J. M.; Humphreys, J. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1975. 11p. (CONF-760104-2). Dep. NTIS $4.50.

From annual meeting of the transportation research board; Washington, District of Columbia, USA (19 Jan 1976).

A comprehensive plan to develop shipping cask technology is described. Technical programs in the disciplines of heat transfer, structures and containment, spent fuel characterization, hot laboratory verification, shielding, and hazards analysis are discussed. Both short- and long-term goals in each discipline are delineated and how the disciplines interrelate is shown. The technologies developed will be used in the design, fabrication, and testing of truck-mounted and rail-car casks. These casks will be used for safely transporting short-cooled, high-burnup Liquid Metal Fast Breeder Reactor (LMFBR) spent fuel from reactors to reprocessing plants. (auth)

9958 IMPROVED RECEPTACLE FOR RADIOACTIVE WASTE. Port, E. A. (Northwestern Univ., Chicago). HLTPA; 29: No. 5, 801-802(Nov 1975).

A safe, simple and convenient container for handling dry radioactive waste requiring minimum capital outlay is described. The container consists of a fibreboard drum, made to the same dimensions as a standard 55 gal waste receptacle, a polyethylene line 18 in. longer than the drum and a funnel top. The system is at present being evaluated under hospital conditions. (UK)

PARTICLE ACCELERATORS

Design, Development, and Operation

Refer also to abstract 10597.

9959 (EUR-5273d-e-f(Vol. 2), pp 955-968) NEUTRON THERAPY INSTALLATION IN THE RADIATION THERAPY DIVISION OF THE HAMBURG-EPPENDORF RADIOLOGICAL UNIVERSITY CLINIC: CONSTRUCTION AND DOSE MEASUREMENTS. Franke, H. D.; Hess, A.; Kraus, H. K.; Magiera, E.; Offermann, B. P. (Univ., Hamburg). Mar 1975. (In German).

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F. R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

The installation of the neutron therapy facility at Hamburg-Eppendorf was finished at the end of 1973. The unit consists of a Dynagen neutron generator with a duoplasmatron ion source, a modified Cossutta target containing about 300 Ci of tritium, and a neutron collimation system with three multilayered cylindrical parts. The revolving central part of this collimator and a special treatment couch allow arc and multiple port therapy with the patient lying in a horizontal position. The machine was tested for more than 8 hours with an unloaded target, and the total neutron yield was determined to be more than 2×10^{12} n/sec. Several total dose profiles perpendicular to the central axis of the beam were measured showing a symmetrical dose distribution. Outside the useful beam the ratio of total dose to neutron dose was determined. (auth)

9960 (IPNO-1974, pp G1-G48) GENERAL ACTIVITIES AND TECHNICAL RESEARCH. [nd]. (In French).

In annual report 1974.

Technical activities at the Nuclear Physics Institute are reported, including: (1) accelerator operation and progress; (2) instrumentation; (3) digital computing and data processing; (4) electronics; (5) mechanics; (6) cryogenics; (7) health physics; and (8) radiation protection. (FR)

9961 (LYCEN-74-34) IMPROVEMENT OF THE ENERGY RESOLUTION OF AN ELECTROSTATIC VAN DE GRAAFF ACCELERATOR. Tholomier, M. (Lyon-1 Univ., 69- Villeurbanne (France)). 1974. 83p. (In French). Dep. NTIS (US Sales Only) $6.00.

Thesis.

Unconventional, but possible methods for improving the energy resolution of a Van de Graaff accelerator are briefly discussed. One method, in which the beam input energy in the accelerator tube is varied, was applied to the Lyon accelerator. Difficulties in the adaptation of the method to the machine led to the development of a fast control circuit, which performed satisfactorily. Unresolved problems in the adaptation are analyzed and some solutions are proposed. (JSR)

9962 SUCCESSFUL TEST AT THE SUPERCONDUCTING PROTOTYPE ACCELERATOR AT KARLSRUHE. Kuntze, M. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Experimentelle Kernphysik). KFK Nachr.; 7: No. 2, 38-39(Jul 1975). (In German)

The first test run of the superconducting proton accelerator prototype is reported. The model consists of two in-phase coupled superconducting helical accelerator cavities. A proton beam of 100 μA was accelerated up to 1.28 MeV. (GE)

9963 CALCULATIONS AND MEASUREMENTS ON A PHASE-FREE ACCELERATING STAGE USING ELECTRIC AC-FIELDS IN A TRIANGULAR SHAPED ELECTRODE SYSTEM. Winter, H. J.; Schott, W. (Technische Univ. Muenchen, Garching (F.R. Germany). Physik-Department). Z. Phys., A; 273: No. 2, 167-175(Jun 1975).

12 figs.; 2 tabs.; 11 refs. Part of the thesis by Winter, H. J.

A phase-free accelerating stage for charged particles was constructed which makes use of electric ac fields in a triangular shaped electrode system combined with ac deflecting devices in the MHz range. An elaborate calculation of the energy gain based on a time dependent Hamiltonian and a simplified calculation assuming perfect shielding within the electrodes was performed. The theoretical results are compared with measurements at a frequency of 13.55 MHz and at peak electrode voltages of 3 kV and 0.5 kV. The maximum energy gain of electrons with an incident energy of 20 keV was measured to be 140 eV at the 3 kV peak voltage. Construction and properties of the retarding-field energy analyzer and of the resonant circuits are given. It is shown that rf driven magnetic deflecting coils diminish the energy gain due to induced electric fields. Rf electric capacitor fields seem to be superior to the rf magnetic fields because they reduce the energy gain very little and furthermore offer a simultaneous phase-free particle acceleration in opposite directions. The possible applications of such a phase-free accelerating stage for heating up a plasma and for producing an intense ring of relativistic electrons are discussed. (auth)

9964 METHODS FOR COMPACT CYCLOTRON PRODUCTION OF INDIUM-111 FOR MEDICAL USE. MacDonald, N. S.; Neely, H. H.; Wood, R. A.; Takahashi, J. M.; Wakakuwa, S. I.; Birdsall, R. L. (Univ. of California, Los Angeles). Int. J. Appl. Radiat. Isot.; 26: No. 10, 631-633(Oct 1975).

A comparative study of methods of ^{111}In production, undertaken to determine the one best suited for compact, multiparticle, moderate energy cyclotrons, currently operating in a number of medical centers is reported. The reactions considered are: ^{112}Cd(p, 2n)^{111}In, ^{110}Cd(d, n)^{111}In, ^{109}Ag(^{3}He^{2+}, n)^{111}In, and ^{109}Ag(^{4}He^{2+}, 2n)^{111}In. Target thickness, incident beam energy, reaction yield, and contaminants at 48 hr are tabulated. (UK)

9965 RELATIVISTIC ELECTRON BEAM DEVICE. Freeman, J. R.; Poukey, J. W.; Shope, S. L.; Yonas, G. (to U. S. Energy Research and Development Administration). US Patent 3,892,970. G21G5/00; G01K1/08. 1 Jul 1975. Filed Date 11 Jun 1974. 8p.

PAT-APPL-478,199.

A design is given for an electron beam device for irradiating spherical hydrogen isotope bearing targets. The accelerator, which includes hollow cathodes facing each other, injects an anode plasma between the cathodes and produces an approximately 10 nanosecond, megajoule pulse between the anode plasma and the cathodes. Targets may be repetitively positioned within the plasma between the cathodes, and accelerator diode arrangement permits materials to survive operation in a fusion power source. (auth)

9966 ALL-MAGNETIC EXTRACTION FOR CYCLOTRON BEAM REACCELERATION. Hudson, E. D.; Mallory, M. L. (to U. S. Energy Research and Development Administration). US Patent 3,896,392. H05H7/04; H05H7/10; H05H13/00. 22 Jul 1975. Filed Date 21 Feb 1974. 4p.

PAT-APPL-444,458.

An isochronous cyclotron can be modified to provide an initial electron stripping stage, a complete acceleration of the stripped ions through the cyclotron to a first energy state, means for returning the ions to an intermediate cyclotron orbit through a second stripping stage, further acceleration of the now higher energy stripped ions through the cyclotron to their final energy, and final extraction of the ions from the cyclotron. (auth)

Auxiliaries and Components

Refer also to abstracts 9189 and 9190.

9967 (JINR-P9-9091) COMPUTATION OF THE MAGNETIC FIELD SYSTEM OF COMPRESSOR WITH THIN-WALLED METALLIC CHAMBER. Part I. Aleksandrov, V. S.; Aleksakhin, Yu, I.; Kazarinov, N. Yu.; Novikov, V. G.; Perel'shtein, E. A.; Shchinov, B. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The method of computation of the multi-stage magnetic field system intended for compression of the intense electron rings in metallic chamber is given. (auth)

9968 (JINR-P9-9141) DETECTOR OF TWO COILS FOR ELECTRON RING PARAMETER MEASUREMENTS IN THE COMPRESSOR IN THE PROCESS OF COMPRESSION. Habanec, J.; Guratzsch, H. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

A two-coil detector, designed for measurements of the electron beam intensity in a collective accelerator compressor and for studies of ring behavior during compression, was tested. The detector makes possible the measurement of the beam parameters without beam decay in the presence of the time varying external magnetic field. A description of the detector, its properties, and its use is presented. (auth)

9969 (ORNL-tr-4064) POLAR PROFILE OF 52^{0} SECTORS. Bibet, D.; Ohayon, M. 29 Oct 1975. Translated by Martha Gerrard from Report No. GANIL 75-38. 26p. Dep. NTIS $5.00.

A study was made of the polar profile of the 52^{0} sector magnet faces for the GANIL heavy ion accelerator project, which was authorized in September, 1975. An attempt was made to find a profile satisfying several conditions, including: (1) the magnetic

angle of the magnet should vary as little as possible for all induction levels; (2) the magnetic and geometric angles of the sector should be equal; (3) the profile should allow for the space occupied by and the environment of the hf cavity; and (4) best use should be made of the space available for trim coil connections. Results of a two dimensional approximation using a computer program are presented. (PMA)

9970 A RING LENS FOR FOCUSING ION BEAMS TO UNIFORM DENSITIES. Johnson, C. H. (Oak Ridge National Lab., Tenn. (USA)). Nucl. Instrum. Methods; 127: No. 2, 163-171 (1 Aug 1975).

An electrostatic lens was designed and built to focus a beam of positive ions into uniform density on a target. The lens has two concentric field regions with a grid separating the inner zero field from the outer radial field. For proper operation, the incident ions must emanate with axial symmetry and Gaussian or similar divergence from a small source. An appendix is included on the symmetrization of elliptical beams by a quadrupole singlet lens. (NL)

Ion Sources and Injection and Extraction Systems

9971 MEANS FOR OBTAINING A METAL ION BEAM FROM A HEAVY-ION CYCLOTRON SOURCE. Hudson, E. D.; Mallory, M. L. (to U. S. Energy Research and Development Administration). US Patent 3,898,496. H01J61/06; H01J61/16. 5 Aug 1975. Filed Date 12 Aug 1974. 4p.

PAT-APPL-497,176.

A description is given of a modification to a cyclotron ion source used in producing a high intensity metal ion beam. A small amount of an inert support gas maintains the usual plasma arc, except that it is necessary for the support gas to have a heavy mass, e.g., xenon or krypton as opposed to neon. A plate, fabricated from the metal (or anything that can be sputtered) to be ionized, is mounted on the back wall of the ion source arc chamber and is bombarded by returning energetic low-charged gas ions that fail to cross the initial accelerating gap between the ion source and the accelerating electrode. Some of the atoms that are dislodged from the plate by the returning gas ions become ionized and are extracted as a useful beam of heavy ions. (auth)

9972 A CATHODE WITH LONG LIFETIME FOR OPERATION OF ION SOURCES WITH CHEMICALLY AGGRESSIVE VAPOURS. Kirchner, R.; Roeckl, E. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Nucl. Instrum. Methods; 127: No. 2, 307- 309(1 Aug 1975).

A capsule cathode heated by electron bombardment is described for operation of ion sources with chemically aggressive vapors. (NL)

9973 A CaH^- SOURCE FOR TANDEM ACCELERATORS. Dumail, M.; Mouffron, J. P. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). Nucl. Instrum. Methods; 127: No. 2, 305-306(1 Aug 1975). (In French).

A CaH^- beam was produced by sputtering in a Penning discharge. (NL)

9974 THE POLARIZED PROTON AND DEUTERON SOURCE FOR THE BONN ISOCHRONOUS CYCLOTRON. Schumacher, W.; Barz, F.; Dreesen, E.; Hammon, W.; Hansen, H. H.; Penselin, S.; Scholzen, A. (Bonn Univ. (F. R. Germany). Inst. fuer Angewandte Physik). Nucl. Instrum. Methods; 127: No. 2, 157-162(1 Aug 1975).

An atomic-beam polarized ion source for production of polarized protons and deuterons at the Bonn isochronous cyclotron is described. At the end of the source, a proton beam of 1.5 μA or a deuteron beam of 2 μA is obtained (typical values). The emittance of the beam corresponds to the acceptance of the cyclotron. A tensor polarization value $P_{zz} = 0.8$ of the deuteron beam was measured via $T(d,n)^4He$. For the proton beam, a polarization of P approximately 0.6, and, for the deuteron beam, a vector polarization of P_z approximately 0.5 is to be expected. (NL)

9975 A VERSATILE OFF-LINE PROCESSOR. George, K. R. (Auckland Univ. (New Zealand). Dept. of Physics). Nucl. Instrum. Methods; 127: No. 2, 249-251(1 Aug 1975).

An off-line computer peripheral was developed to monitor experiments on a polarized ion source. Although the buffer store was built to monitor and use signals associated with nuclear experiments, it may be used as a data collector for a wide variety of applications. For applications where event rates are higher than 64 μs and a reduction in the parameter processing time is required, more expensive ADCs with faster conversion times could be used. The memory has a maximum shift-in shift-out rate of 1 MHz, which for intended applications, does not limit processing time. (NL)

Ion Optics and Field Calculations

9976 (JINR-P9-9244) STUDY OF THE LONGITUDINAL RELATIVISTIC ELECTRON RINGS. I. Analytic Theory. Getmanov, B. S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 25p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

A theory of longitudinal instability of relativistic electron rings (RER) in the thin ring model is suggested without the restriction of small deviations of the frequency of perturbated particles from the average. The theory also takes into account both the imaginary and the real parts of the impedence. Expressions are obtained for the energy, ring radiation power, and instability increments, and the peculiarities of the integral-differential equation system which describes the RER instability evolution were studied qualitatively. (auth)

9977 (JINR-P9-9245) STUDY OF THE LONGITUDINAL INSTABILITY OF THE RELATIVISTIC ELECTRON RINGS. II. Numerical Simulation. A Ring in a Free Space. Getmanov, B. S.; Makhankov, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 25p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

Formulation of a problem and numerical results on the longitudinal instability of relativistic electron rings in free space are presented. (auth)

9978 LINEAR STABILITY ANALYSIS OF A CLASS OF SOLUTIONS OF THE FILAMENT MODEL FOR A STATIONARY-FIELD ELECTRON RING ACCELERATOR. Chen, T. J. London; University of Western Ontario (1974). National Library of Canada, Ottawa.

Thesis (Ph. D.).

The stability of two of the short time scale solutions obtained in the filament model for a stationary field electron ring accelerator is studied by means of a linearized perturbation on the electron and ion distribution functions. The Vlasov equations for the electrons and ions are coupled, resulting in a Fredholm integral equation which can be converted into an infinite system of linear equations. A stability criterion is then obtained from the zeros of the truncated determinants of the infinite system coefficients. One of the equilibrium solutions, characterized by the dimensionless parameter epsilon equals 0, is entirely stable. The other solution, characterized by epsilon greater than 0, is stable, provided that both epsilon and the ratio of the square of the ion period to that of the electrons are not too large. (Diss. Abstr. Int., B)

Storage Rings

9979 (LBL-4433) STRONG TURBULENCE AND THE ANOMALOUS LENGTH OF STORED PARTICLE BEAMS. Channell, P. J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nov 1975. Contract W-7405-ENG-48. 102p. Dep. NTIS $6.50.

Thesis.

A theoretical analysis is made of the longitudinal stability of intense beams of charged particles in high energy storage rings. The effect of externally applied radiofrequency fields, i.e., synchrotron oscillations, is included. For electron and positron beams, the damping and quantum excitation due to particle radiation are also included. A criterion for the stability of small longitudinal plasma oscillations is derived and used to obtain the stable size of intense stored beams of electrons and positrons. (auth)

9980 A PRECISION LUMINOSITY MONITOR FOR USE AT ELECTRON-POSITRON STORAGE RINGS. Crawford, J. F.; Hughes, E. B.; O'Neill, L. H.; Rand, R. E. (Stanford Univ., Calif. (USA). High-Energy Physics Lab.). Nucl. Instrum. Methods; 127: No. 2, 173-182(1 Aug 1975).

A precision luminosity monitor is described which was used successfully in an experimental test of quantum electrodynamics at the 2.6 GeV electron-positron storage ring (SPEAR-I) at the Stanford Linear Accelerator Center. Design considerations and construction details are given, together with a discussion of radiative corrections and an evaluation of the response of the monitor. (NL)

Experimental Facilities

Refer also to abstracts 9375 and 9406.

9981 (LA-UR-75-2181) SOFTWARE SYSTEM FOR DATA ACQUISITION IN NUCLEAR PHYSICS EXPERIMENTS USING CAMAC. Minor, M. M.; Shlaer, S.; Thomas, R. F. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 7p. (CONF-751116-19). Dep. NTIS $3.30.

From nuclear science symposium; San Francisco, California, USA (17 Nov 1975).

An event-oriented, modular software system for data acquisition in nuclear physics experiments was implemented on PDP-11 computers under the RSX-11D operating system. The system is designed to support high-speed data acquisition in a broad variety of nuclear physics experiments having multiple event types and using CAMAC instrumentation as the experimental interface. The system provides a simple, problem-oriented language for the specification of CAMAC operations to acquire data from each class of event. It provides automatic buffering of experimental data from the CAMAC hardware and recording on magnetic tape. Certain common utility functions are provided, especially histogram entries and plotting on on-line displays, along with associated operator control functions. The experimenter specializes the system to his needs by writing FORTRAN subroutines which specify necessary on-line analysis of data and control histogram entry. The software depends on a special event-trigger module which was designed in conjunction with the software and is used to identify the various different classes of events, to facilitate manual control and testing of an experiment, and to facilitate communication between different software modules in the system. 3 figures. (auth)

9982 AN ELECTROSTATIC PLUNGER DEVICE AND THE ANALYSIS OF RECOIL-DISTANCE SPECTRA. Marchie van Voorthuysen, E. H. du; Smith, Ph. B. (Rijksuniversiteit Groningen (Netherlands)). Nucl. Instrum. Methods; 127: No. 2, 205-215(1 Aug 1975).

In the electrostatic plunger apparatus, a large stopper foil is drawn towards the target electrostatically. The attracting field is controlled in a feedback loop by the capacity, so that the distance is stabilized during the measurement. Formulae for line-shape analysis of γ-ray spectra from recoil-distance lifetime measurements (RDM) are given. A measurement of the life-time of the 1759 keV level in ^{26}Al is reported yielding (3.44 ± 0.6) ps, in agreement with results from Doppler-shift attenuation, but in disagreement with other RDM results. In addition, accurate stopping-power measurements are reported for 2-9 MeV alpha particles in Al, Ni, Cu, Au and Mylar. (NL)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

9983 (CONF-750979-(Absts.)) 39th PHYSICS CONFERENCE, MUNICH, GERMANY, SEPTEMBER 1–5, 1975. Abstracts. (Deutsche Physikalische Gesellschaft e.V., Bonn-Bad Godesberg (F. R. Germany)). 1975. 143p. (In German and English). Dep. NTIS (US Sales Only) $7.00.

The program for the 39th Physics Conference of the German Physical Society, held September 1–5, 1975, at Munich, is given. Abstracts for the papers presented are in German or English. (RWR)

9984 TIDAL CAPTURE FORMATION OF BINARY SYSTEMS AND X-RAY SOURCES IN GLOBULAR CLUSTERS. Fabian, A. C.; Pringle, J. E.; Rees, M. J. (Cambridge Univ., Eng.). Mon. Not. R. Astron. Soc.; 172: No. 2, 15P-18P(Aug 1975).

It is proposed that the x-ray sources associated with globular clusters are very close binary systems. These result from the tidal capture of compact objects by ordinary stars in the core of the cluster. (auth)

Cosmic Radiation

Refer also to abstracts 10117, 10130, and 10356.

9985 PRECISE MEASUREMENT OF THE VERTICAL MUON SPECTRUM IN THE RANGE 20 TO 500 GeV/c. Ayre, C. A.; Baxendale, J. M.; Hume, C. J.; Nandi, B. C.; Thompson, M. G.; Whalley, M. R. (Univ. of Durham, Eng.). J. Phys., G (London); 1: No. 5, 584-600(20 Jun 1975).

The 300 ton cosmic ray spectrograph (MARS) has been used to measure the vertical momentum spectrum of cosmic ray muons in the momentum range 20 to 500 GeV/c at sea level. The differential spectrum is well represented by the logarithmic polynomial $p^3\,N(p) = -0.524 + 0.366(\ln p) - 0.0445(\ln p)^2 + 0.0008\,(\ln p)^3$ where p is in GeV/c and N(p) is in $s^{-1}\,cm^{-2}\,sr^{-1}\,(GeV/c)^{-1}$. (auth)

9986 ARRIVAL TIME DISTRIBUTION OF MUONS IN EXTENSIVE AIR SHOWERS. Armitage, M. L.; Blake, P. R.; Nash, W. F. (Univ. of Nottingham, Eng.). J. Phys., A (London); 8: No. 6, 1005-1013(Jun 1975).

The time spread of muons within EAS has been determined by measuring the time of arrival of individual muons with respect to the extreme shower front with an accuracy of ±10 ns. The integral time distributions averaged over a group of showers are presented as a function of shower parameters. For near vertical showers it is found that the 10% to 90% time spread of muons increases from about 100 ns at an EAS core distance of 150m to about 160 ns at 450 m. These results are shown to be in reasonable agreement with predictions based on model calculations. (auth)

9987 ANISOTROPY OF ULTRA-HIGH-ENERGY COSMIC RAYS. I. Large-Scale Features. Kiraly, P.; White, M. (Univ. of Durham, Eng.). J. Phys., A (London); 8: No. 8, 1336-1348 (Aug 1975).

Until a few months ago there seemed to be no evidence for any large-scale anisotropy in the arrival directions of ultra-high-energy ($E > 10^{17}$ eV) cosmic ray primaries. In a recent letter, Krasilnikov et al, however, have put forward some evidence for a huge anisotropy above 10^{19} eV, and this evidence has been claimed to be supported by some earlier results at lower energies. The present paper gives a detailed discussion of the statistical selection effects involved and concludes that the anisotropy is not proven. Some astro-physical implications of the anistropy, if genuine, are also considered. (auth)

9988 SECOND SPHERICAL HARMONICS OF THE COSMIC RAY ANGULAR DISTRIBUTION. Kota, J. (Kozponti Fizikai Kutato Intezet, Budapest). J. Phys., A (London); 8: No. 8, 1349-1360(Aug 1975).

Explicit expressions describing the semi-diurnal variation of cosmic ray intensity are obtained in the frame of the convection-diffusion theory. Convection-diffusion equations are extended by introducing a symmetric traceless tensor accounting for the second harmonics of the cosmic ray angular distribution. Starting from the statistical Boltzmann equation a new transport equation is deduced which relates the second harmonics of the angular distribution to the gradients of cosmic ray streaming. Thus, compared to models used hitherto, a more quantitative calculation is carried out. Expressing the free space anisotropy in terms of geographical coordinates, the predicted diurnal and semi-diurnal variations are given. The results obtained are essentially in agreement with those of Quenby and Lietti but also differences arise as a result of the bending and divergence of the large-scale interplanetary magnetic field lines. Arguments are brought forward that a sunward cosmic ray streaming along the interplanetary field lines gives rise to a pitch angle distribution with an excess of particles of large pitch angles. (auth)

9989 SURFACE AND UNDERGROUND MEASUREMENTS OF LONG-TERM CHANGES IN THE COSMIC RAY SOLAR DIURNAL VARIATION. Thambyahpillai, T.; Speller, R. D. (Imperial Coll. of Science and Tech., London). Planet. Space Sci.; 23: No. 6, 961-971(Jun 1975).

North/south directional telescopes operating at the surface and vertical and inclined telescopes operating at a depth of 60 MW(e) underground in London have been employed to study changes in the cosmic ray solar diurnal variation over the past few years. In order to extend the study to the low rigidity end of the spectrum, results obtained by the NM64 neutron monitors operating at Deep River and Goose Bay in Canada have also been examined. The surface telescope data require that the full corotation amplitude of 0.59% should have been observed during almost the entire solar cycle with the possible exception of the year 1965 when cosmic ray intensity was a maximum. However, the effective amplitude observed by neutron monitors during most of the solar cycle was only about 0.52% and this reduction has been ascribed to the lower value of the exponent of the energy spectrum which prevails amongst the latitude sensitive primaries. Nevertheless, the upper limiting rigidity was varying during the course of the solar cycle, its value being high when solar activity was high and low when solar activity decreased. During 1965, even though the upper limiting rigidity assumed its lowest value, the free space amplitude was also diminished by a little over 10%. Even though the theory of rigid corotation, invoking a purely azimuthal streaming of the cosmic ray gas, successfully predicts the free space amplitude, it fails to explain the phase changes observed by both types of monitor and which are quite significant. The underground data require that the component due to atmospheric temperature effects is negligibly small and that throughout the rigidity range covered by the recorder response, there is present an apparent anisotropy due to the orbital motion of the earth around the sun. Also the underground data roughly confirm the changes in upper limiting rigidity which were observed by the surface instruments. (auth)

9990 DISSOCIATIVE RECOMBINATION CONTRIBUTIONS TO I(5577) AND I(6300)[OI] N_mF2 ENHANCEMENTS RESULTING FROM MODERATE PROTON PCA EVENTS. Porter, H. S.; Edgar, B. C.; Green, A. E. S. (Univ. of Florida, Gainesville). Planet. Space Sci.; 23: No. 6, 935-944(Jun 1975).

The dissociative recombination contribution to I(5577) and I(6300) of [OI] as a function of low energy cutoff for two measured solar proton spectra is investigated. The volume ionization rate profiles used in the calculation are obtained using a detailed atomic cross section approach in the continuous slowing down approximation. The ratio of the dissociative recombination contribution to the direct impact contribution for both the 5577 Å and 6300 Å [OI] emissions is found to be dependent upon the low energy cutoff. This ratio has a nominal value of ~2.0 for the 5577 Å [OI] emission and ~0.25 for the 6300 Å [OI] emission. The I(5577)/I(3914) and I(6300)/I(3914) ratios including the direct and dissociative recombination contributions are strongly dependent upon the low energy cutoff of the spectrum. F-layer enhancements resulting from the low energy spectrum component have also been investigated. For the Mizera spectrum with a low energy cutoff of 12.4 keV, and N_mF2 of $\sim 4.5 \times 10^5$ electrons/cm^3 or about 10% of the ionization required to maintain the dipole at a value of 5×10^4 electrons/cm^3 was found. Extension to the cutoff to 1 keV results in $\sim 1 \times 10^4$ electrons/cm^3, or about 20% of the required maintenance ionization. (auth)

9991 CAN SOFT γ-RAY BURSTS BE EMITTED BY ACCRETING BLACK HOLES. Piran, T.; Shaham, J. (Hebrew Univ., Jerusalem). Nature (London); 256: No. 5513, 112-113 (10 Jul 1975).

It is stated that, although a number of models have been proposed for observed γ-ray bursts, none has proved entirely satisfactory. Another possible model is here suggested, involving production of the γ-rays by inverse Compton processes occurring deep in the ergosphere of a fast rotating and accreting black hole. According to this model the black hole is probably a member of a binary system and, depending on its steady state accretion rate, may or may not be observable as an x-ray source. (UK)

9992 ULTRAVIOLET EXPERIMENT ONBOARD THE ASTRONOMICAL NETHERLANDS SATELLITE (ANS). van Duinen, R. J.;

Aalders, J. W. G.; Wesselius, P. R.; Wildeman, K. J.; Wu, C. C.; Luinge, W.; Snel, D. (Rijksuniversiteit Groningen (Netherlands). Kapteyn Astronomical Inst.). Astron. Astrophys.; 39: No. 1, 159-163(Feb 1975).

The ultraviolet experiment package onboard the ANS consists of a 22 cm diameter Cassegrain telescope, followed by a five channel intermediate band spectrophotometer. The instrument response function for each bandpass is almost rectangular. The central wavelengths are 155, 180, 220, 250 and 330 nm respectively. The in orbit performance of the instrument is according to expectations. Observational results of some typical objects are summarized to illustrate the capabilities of the instrument. (auth)

9993 PROBLEMS OF COMPONENT DISCRIMINATION IN SPACE RADIATION DOSIMETRY. Schaefer, H. J. (Naval Aerospace Medical Research Lab., Pensacola, Fla. (USA)). Radiat. Environ. Biophys.; 12: No. 2, 127-137(Jul 1975).

Resolving the LET spectrum of environmental radiation in space for assessing dose equivalents creates special problems due to superposition effects. These components of the radiation field in space, trapped protons, tissue disintegration stars, and neutrons, contribute the bulk of the total dose equivalent. While lack of discrimination of neutron recoil and trapped primary protons does not interfere with correct determination of the combined dose equivalent as such, the simultaneous bursts of several low-energy protons and alpha particles from tissue disintegration stars completely defy LET-resolution with conventional instrumentation. So far, the tissue star dose has been determined only semiquantitatively from nuclear emulsion data. The neutron spectrum in space shows a markedly higher relative fluence in the region beyond 5 MeV than the fission neutron spectrum. Therefore, its LET spectrum centers less heavily on LET values near the proton Bragg Peak. This would call for assigning a QF value of less than 10 to the neutron dose in space. Still more serious shortcomings exist with regard to LET interpretation of heavy primaries. (auth)

9994 PROGRESS REPORT ON THE RADIAL GRADIENTS OF COSMIC RAY NUCLEI 0.5 MeV PER NUCLEON TO RELATIVISTIC ENERGIES AND ELECTRONS 6 TO 30 MeV. Simpson, J. A.; Conlon, T. F.; McKibben, R. B.; Tuzzolino, A. J.; O'Gallagher, J. J. (Univ. of Chicago). pp 214-216 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA. USA (25 Mar 1974).

9995 ORIGIN AND COMPOSITION OF HEAVY NUCLEI BETWEEN 10 AND 60 MeV PER NUCLEON DURING INTERPLANETARY QUIET TIMES IN 1968-1972. Mogro-Campero, A.; Simpson, J.A. (Enrico Fermi Institute, University of Chicago). Astrophys. J. 200: No. 3, 773-786 (15 Sept 1975).

The relative abundances of the nuclei B-Si, the group P-V, and the group Cr-Ni (the iron group) have been measured with an instrument on the OGO-5 satellite in the energy range $\sim$10 to 60 MeV nucleon^{-1} in the period of changing solar modulation in the 1968-1971. Stringent criteria were applied for the selection of interplanetary quiet-time data in order to eliminate the highly variable solar component. The purpose of the investigation was to obtain evidence for the solar or galactic origin of the nuclei in this energy range where it is known that the H and He spectra display striking differences in shape from the galactic cosmic-ray spectra at higher energies. We find that: (1) The relative abundances are in good agreement with nuclear abundances of the galactic cosmic rays. For example, since we find that boron has an abundance relative to oxygen which is characteristic of the secondary nuclei in the galactic radiation, the component we are measuring is not characteristic of solar abundances. (2) The differential energy spectra of C and O are found to diverge at these low energies from the characteristic modulated galactic spectra; i.e., if $J \propto E^{\gamma}$ represents the spectral form in this energy region, with $\gamma = 1.0$ at the higher energies, we find $\gamma \to 0$ with decreasing energy. (3) During the change in solar cycle modulation from 1968 to 1971, the changes in C+N+O flux were observed to undergo a phase lag in time with respect to the high-energy galactic cosmic rays which was the same as the phase lag for helium nuclei of galactic origin in the energy range 30 to 100 MeV nucleon^{-1}. These measurements were extended to a brief period in 1972. It is concluded that the experimental evidence favors a galactic origin for the nuclei in this energy range, and that the spectral forms of C and O are consistent with the spectral forms for H and He which become $J \propto E^{-3}$ below $\sim$ 10 MeV nucleon^{-1} before 1972 under quiet-time conditions. It is pointed out that if these are modulated interstellar spectra, then additions to our current ideas must be introduced into modulation theory or its boundary conditions to account for the propagation through the heliosphere, or, alternatively, that a spectral form generated in the heliosphere—for example, by heliospheric acceleration of nuclei entering from interstellar space—may occur. The recent reports by other investigators on the appearance in 1972-1973 of anomalous spectral changes in the He, C, N, and O components at these energies are compared with our 1968-1971 observations. This paper contains a description of the University of Chicago instrument on the OGO-5 satellite. (auth)

9996 Kα X-RAYS FROM COSMIC-RAY OXYGEN. Pravdo, S.H.; Boldt, E.A. (NASA/Goddard Space Flight Center). Astrophys. J. 200: No. 3, 727-733 (15 Sept 1975).

Equilibrium charge fractions are calculated for subrelativistic cosmic-ray oxygen ions in the interstellar medium. These are used to determine the expected flux of Kα rays arising from atomic processes for a number of different postulated interstellar oxygen spectra. Relating these results to the diffuse X-ray background measured at the appropriate energy (i.e., $\sim$0.6 keV) suggests an observable broadened line feature. (auth)

9997 THE EVOLUTION OF THE COSMIC RADIATION SPECTRUM UNDER THE INFLUENCE OF TURBULENT HEATING. I. THEORY. Chan, K.L. (IBM Thomas J. Watson Research Center, Yorktown Heights, New York); Jones, B.J.T. Astrophys. J. 200: No. 2, 454-460 (1 Sept 1975).

Assuming that a radiative fluid is incrompressible and has rather homogeneous physical conditions, we show that the evolution of the spectrum of the radiation field under viscous heating is described by an equation similar to that derived by Kompaneets. Since we include the effects of stimulated emission and keep the accuracy of the calculation to second order, we are able to consider the effect of the thermal motion as well as the effect of fluid motion on the radiation spectrum simultaneously. (auth)

9998 THE EVOLUTION OF THE COSMIC RADIATION SPECTRUM UNDER THE INFLUENCE OF TURBULENT HEATING. II. NUMERICAL CALCULATION AND APPLICATION. Chan, K.L. (Department of Physics, Princeton University); Jones, B.J.T. Astrophys. J. 200: No. 2, 461-470 (1 Sept 1975).

Using the evolutionary equation of the spectrum of the background radiation obtained in the first paper of this series, we study the distortions of the cosmic microwave background radiation spectrum resulting from fluid energy input to the radiation field by analytical approximations and numerical integrations. The results are then used to reevaluate the constraints on the theory of cosmic turbulence imposed by the observations in the Rayleigh-Jeans part of the radiation spectrum. (auth)

9999 PION PRODUCTION SPECTRUM AT THE ATMOSPHERE IN THE ENERGY RANGE 3 TO 100 GeV. Bhattacharyya, D. P.; Basu, D. (Indian Association for the Cultivation of Science, Jadavpur, India). Indian J. Phys.; 49: No. 5, 346-349(May 1975).

The pion production spectrum in the atmosphere is derived by using the recent parameters on the high energy inelastic interactions (pp) from the machine experiments and by using CE model from the satellite data on the primary spectrum of Grigorov et al (1971) which is in accord with that of Allen & Apostolakis (1961), Coates & Nash (1962), Judge & Nash (1965). Pion production spectrum assumes the form $P(E_{\pi})dE_{\pi} = 0.34E_{\pi}^{-2.8}dE_{\pi}$ in the pion energy range 3 to 100 GeV. (auth)

Stars

Refer also to abstracts 9984, 9991, 10088, 10092–10094, 10102, 10130, 10165, 10186, 10581, and 11035.

10000 (LA-6149-MS) GENERAL NUMERICAL FLUID DYNAMICS ALGORITHM FOR ASTROPHYSICAL APPLICATIONS. Ruppel, H. M.; Cloutman, L. D. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1975. Contract W-7405-ENG-36. 15p. Dep. NTIS $4.00.

Finite difference simulation of fluid flows under astrophysical conditions is often complicated by factors such as complex gas physics, the occurrence of dynamics at widely differing length scales, and the necessity of using implicit difference equations. This report describes a simple, general, and efficient algorithm for solving one-dimensional, spherically symmetric problems using a variation of the ICED-ALE method. A computer code named VEGA has been written based on this algorithm, and the early stages of the collapse of a one-solar mass protostellar cloud are presented as a sample solution. (auth)

10001 (LBR-75-04) ISOTOPES OF CARBON, NITROGEN, AND OXYGEN AS PROBES OF NUCLEOSYNTHESIS, STELLAR MASS LOSSES, AND GALACTIC EVOLUTION. Audouze, J.; Lequeux, J.; Vigroux, L. (Centre National de la Recherche Scientifique, 91—Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). 1975. 38p. INIS.

Evidences for a $^{12}C/^{13}C$ ratio different in the interstellar medium and in the solar system (40 instead of 89) and for a large N/O ratio in the centers of galaxies are reviewed and are explained by an enrichment of the interstellar medium in ^{13}C and N by mass loss of stars of various masses. (FR)

10002 COLD HI SHELL AROUND THE SUPERNOVA REMNANT W 44. Cornett, R. H.; Hardee, P. E. (Maryland Univ., College Park (USA). Astronomy Program). Astron. Astrophys.; 38: No. 2, 157-160(1975).

Recent observations of the supernova remnants W 44 and HB 21 suggest the existence of neutral hydrogen shells expanding away from the supernova remnants with a velocity of a few kms^{-1} and a radius several times that of the radio continuum source. It appears that the object associated with W 44 can be explained as hydrogen set in motion by pressure gradients resulting from X-ray or cosmic ray heating by the supernova or its remnant. (auth)

10003 POSSIBLE RELATION BETWEEN SPECTRAL INDEX AND Z-DISTRIBUTION FOR SUPERNOVA REMNANTS. Becker, R. H. (Maryland Univ., College Park (USA). Astronomy Program); Kundu, M. R. (Maryland Univ., College Park (USA). Astronomy Program; National Aeronautics and Space Administration, New York (USA). Goddard Inst. for Space Studies). Astron. Astrophys.; 38: No. 1, 149-152(Jan 1975).

A statistical relation has been found between spectral index and the mean distance from the galactic plane for supernova remnants. Using z-distances calculated from the Σ-D relationship and the observed spectral indices at radio frequencies for 93 galactic supernova remnants, the mean z-distance is found to vary from approximately 175 pc to approximately 60 pc for remnants with flat and steep spectra respectively. A possible correlation between flat-spectra supernova remnants and pulsars is discussed. (auth)

10004 NUMERICAL MODELS OF ROTATING STARS. Auchmuty, J. F. G. (Indiana Univ., Bloomington (USA). Dept. of Mathematics). pp 40-44 of Proceedings of the Fourth International Conference on Numerical Methods in Fluid Dynamics. Richtmyer, R. D. (ed.). (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics). Heidelberg; Springer (1975).

From 4th international conference on numerical methods in fluid dynamics; Boulder, Colo. (24 Jun 1974).

Rotating stars are modelled by the equilibrium solution of the Euler equations for a compressible, inviscid fluid subject to selfgravitational and centrifugal forces. There are many difficulties in trying to solve this equation directly. Here, a new method is described, based on discretizing the functional $E(\rho)$ and the constraint for density and minimizing the resulting finite dimensional function. (GE)

10005 ORIGIN OF THE BINARY PULSAR PSR 1913 + 16. Flannery, B. P.; van den Heuvel, E. P. J. (Institute for Advanced Study, Princeton, N. J. (USA)). Astron. Astrophys.; 39: No. 1, 61-67(Feb 1975).

We suggest that the progenitor of the binary pulsar PSR 1913 + 16 could have been a cataclysmic variable (CV)-binary or an evolved massive X-ray binary. In both cases a range of satisfactory initial binary periods and masses can be found if one postulates that a small kick (approximately 200 km/s) is imparted to the remnant pulsar by a slightly asymmetric supernova explosion. In the second case such an asymmetric explosion is not absolutely required. In the first (CV)-scenario the companion of the pulsar is a temporarily undersized lower main-sequence star, stripped of its envelope by the explosion. In this case the apsidal motion period of the PSR 1913 + 16 system is predicted to be a few months; upon reexpansion of the companion, such a system may become a low-mass X-ray binary of a type similar to Sco X-1. The second scenario implies that the companion is a collapsed star and the system has only a small general relativistic apsidal motion. (auth)

10006 MULTIFREQUENCY STUDY OF THE RADIO STRUCTURE OF 3C10, THE REMNANT OF TYCHO'S SUPERNOVA. Duin, R. M.; Strom, R. G. (Rijksuniversiteit Leiden (Netherlands). Sterrewacht). Astron. Astrophys.; 39: No. 1, 33-42 (Feb 1975).

Synthesis observations of 3C10 have been made at 6 cm and 50 cm using the Westerbork telescope. Combining these results with earlier 21 cm Westerbork maps, we have made detailed comparisons between the three wavelengths. The total intensity maps are remarkably similar: we find no evidence for changes in the spectral index of small scale features around the rim of the shell-like remnant. On the large scale, however, there appears to be a significant steepening of the spectrum near the center of 3C10. We believe this to be related to the fact that the integrated radio spectrum steepens at low frequencies and suggest that particles presently near the outer boundary may be accelerated with a relatively flat energy spectrum. Although no linear polarization exceeding about 1% of the total intensity could be detected at 50 cm, at 6 cm the polarized emission is quite smooth, being typically 10% of the total intensity. The position angle distribution of the linear polarization is also smooth, confirming our earlier conclusion that 3C10 is surrounded by an irregular Faraday screen. By comparing our 6 cm map with 2.8 cm and 10.4 cm results we are able to construct a rotation measure map, and confirm that the intrinsic position angles are tangentially aligned, with an average rotation measure of -249 rad m^{-2}. We conclude that the ordered component of the magnetic field is radially directed, and suggest that the mechanism for producing such a configuration can be found in the Sedov solution for shock waves in a fluid medium. (auth)

10007 W44: A BUOYANT SUPERNOVA REMNANT. Jones, E. M. (Los Alamos Scientific Lab., N. Mex. (USA)). Astron. Astrophys.; 39: No. 1, 143-146(Feb 1975).

If the HI shell observed around supernova remnant W44 is identified as the fossil blast wave, W44 is 7 million years old. The apparent 13 pc buoyant displacement of the non-thermal source has been produced by a 0.7 pc $Myr^{-2} = 2.1 \times 10^{-9}$ cm s^{-2} local gravitational field. This acceleration is twice the mean Oort value at the altitude of W44. The acceleration vector is inclined about 30 degrees from the normal vector to the galactic plane. (auth)

10008 LINE-LEAKING MODEL FOR SILICON MONOXIDE MILLIMETRE WAVELENGTH EMISSION. Pelling, M. (Oxford Univ.). Mon. Not. R. Astron. Soc.; 172: No. 2, 421-425(Aug 1975).

Radiative transfer theory is applied to the determination of population ratios of the pairs of pure rotational energy levels giving rise to SiO millimetre lines at 43, 86, and 129 GHz. The result is that, within the confines of the model, the required population ratios cannot be found. However, it does emerge that there is inversion in alternate levels J, J-2 belonging to a given vibrational state. Most probably each level is inverted relative to the next lower, and this gives fair agreement with observation. (auth)

10009 FAR-ULTRAVIOLET SPECTRUM OF NGC 6543. Boksenberg, A. (University Coll., London); Carnochan, D.; Cahn, J.; Wyatt, S. P. Mon. Not. R. Astron. Soc.; 172: No. 2, 395-400(Aug 1975).

The far-ultraviolet spectrum (1350-2550 Å) of the central star of the planetary nebula, NGC 6543, has been obtained by the S2/68 sky-survey telescope in the TD-1A European satellite. It is possible to fit a blackbody function at 35,000 K to this spectrum. Attempts to fit the observed spectrum to Cassinelli's spherical models of planetary central stars suggest temperatures in the range $40{,}000\ K \leq T(\tau = {}^{2}/_{3}) \leq 50{,}000$ K. In support of these results, Zanstra calculations depending on stellar and nebular visible radiation yield a blackbody temperature of 45,000 K and a temperature $T(\tau = {}^{2}/_{3}) = 36{,}000$ K for Cassinelli's models. The adopted temperature and angular stellar radius are $(40{,}000 \pm 4{,}000)$K and $(2.5 \pm 0.5) \times 10^{-11}$ rad, respectively. The temperature and range of likely luminosities of the central star place it near the beginning of the Harman-Seaton evolutionary sequence, consistent with an enveloping planetary nebula that is young and optically thick. (auth)

10010 INFRARED EXCESS OF COOL GIANT STARS: A CHROMOSPHERIC CONTRIBUTION. Lambert, D. L.; Snell, R. L. (Univ. of Texas, Austin). Mon. Not. R. Astron. Soc.; 172: No. 2, 277-288(Aug 1975).

The idea that the infrared excesses of evolved M stars may contain a contribution from a chromosphere is explored with α Ori and W Hya as test cases. The α Ori spectrum between 8 and 30 μm can be interpreted satisfactorily in terms of three components: a photosphere, a silicate dust cloud and a cool chromosphere, $T \sim 5000$ K, which is optically thick at 14 μm. A similar modelling for W Hya suggests a hotter chromosphere, $T \sim 8000$ K, with unit optical depth at 30 μm. Some consequences of these chromospheres are briefly discussed. (auth)

10011 PULSARS. ter Haar, D. (Oxford Univ.). Contemp. Phys.; 16: No. 3, 243-256(May 1975).

A brief survey is given of the most important observational features of pulsars and of some of the theoretical conclusions drawn from these data. The implications of the discovery of a binary pulsar are also briefly discussed. (auth)

10012 RR LYRAE VARIABLE HD 268892. Andrews, P. J. (Radcliffe Observatory, Pretoria). Mon. Not. R. Astron. Soc.; 172: No. 2, 271-275(Aug 1975).

HD 268892 is shown to be a metal-poor c-type RR Lyrae variable with period 0.328936 days. It has a high radial velocity and lies in front of the Large Magellanic Cloud. (auth)

10013 ANOTHER MAJOR CHANGE IN THE RADIO SOURCE ASSOCIATED WITH Cyg X-1. Hjellming, R. M.; Gibson, D. M.; Owen, F. N. (National Radio Astronomy Observatory, Greenbank, WV). Nature (London); 256: No. 5513, 111-112(10 Jul 1975).

Reference is made to the sudden appearance of a faint radio source at the position of Cyg X-1. This source was associated with major changes in the observed x-ray emission during the period February to May 1971. A probable identification with the bright blue star HDE226868 was established. Subsequent optical investigations have established that the object is a binary system with a massive invisible component that may be a black hole. Further observations of Cyg X-1 are here reported, the most recent of which were made after the discovery that Cyg X-1 had undergone another major change in its x-ray state in, or before, early May 1975. The radio observations were made using the NRAO interferometer at 2695 and 8085 MHz. A major characteristic of the Cyg X-1 radio source over the period March 1971 to March 1975 is a flat radio spectrum with a zero spectral index. A new state for the radio source was clearly indicated by data for the period 9 to 20 May 1975, and a particularly interesting feature of the new state is a change of the mean spectral index from 0 to 0.31. (UK)

10014 INFRARED PHOTOMETRY AND POLARIMETRY OF COOL STARS. II. Khozov, G. V.; Khudyakova, T. N.; Larionova, L. V. Uch. Zap. Leningrad. Gos. Univ., Ser. Mat. Nauk; 31: No. 381, 123-146(1975). (In Russian)

The results of the three-color infrared photometry of 26 stars in the I, H, and K bands are given. Polarimetric observations are reported for 7 of these stars (NML Tau, NML Cyg, IRC + IO2I6, VYCMa, BCCyg, SPer, χCyg). Brief discussion of the results is given. The observations were carried out as a part of a program of the study of variability of brightness and polarization of IR stars. (auth)

10015 STRUCTURE AND STABILITY OF A POLYTROPE WITH AN ISOTHERMAL CORE. Yabushita, S. (Kyoto Univ.). Mon. Not. R. Astron. Soc.; 172: No. 2, 441-453(Aug 1975).

Investigation is made of the structure of a gaseous sphere with a polytropic envelope of index 1.5 and isothermal core. It is shown that if the transition from isothermal state to polytropic equation of state occurs at given density and pressure, the mass-central density diagram of the configuration is very similar to the corresponding one of neutron star models, and that there exists a mass peak in the diagram. Dynamical stability is investigated by making use of the equation of radial motion and it is shown that if the adiabatic index, $\gamma = (\rho/p)\,(dp/d\rho)$ as calculated by the equation governing the unperturbed state, dynamical instability sets in precisely at the mass peak, while if γ is raised in the envelope, the instability sets in beyond the mass peak. (auth)

10016 IDENTIFICATION OF ^{3}He IN THE BINARY SYSTEM 68u HERCULIS. Hilditch, R. W.; Hill, P. W. (Saint Andrews Univ., Eng.). Mon. Not. R. Astron. Soc.; 172: No. 2, 29P-34P (Aug 1975).

From a radial velocity study of 60 spectrograms of the binary system 68u Herculis, systematic velocity differences have been found to exist between the He I singlet lines and the He I triplet lines of the primary component. These differences are independent of orbital phase, date of observation of spectrograph employed and can be interpreted in terms of the existence of a large fraction of He^3 in the atmosphere of the primary component. A He^3/He^4 ratio of between 4:1 and 49:1 is suggested. (auth)

10017 STELLAR STABILITY IN CLOSE BINARY SYSTEMS. Papaloizou, J. C. B.; Bath, G. T. (Oxford Univ.). Mon. Not. R. Astron. Soc.; 172: No. 2, 339-357(Aug 1975).

The linear adiabatic stability of stars in close binary systems is discussed. Both spherical and Roche geometries are considered. Two destabilizing influences are shown to exist. These are related to previously discussed instability mechanisms. Examination of the stability of models nearly filling the critical equipotential shows that the boundary condition used by Bath is the most appropriate one to use in the spherical case. Detailed Roche models are constructed and their stability properties determined. It is concluded that dynamical instabilities may be important in dwarf novae, slow novae and the binary symbiotic stars. (auth)

10018 EFFECTS OF INTRINSIC POLARIZATION OF ECLIPSING BINARIES VW CEP AND RW TAU. Shulov, O. S.; Kopatskaya, E. G. Uch. Zap. Leningrad. Gos. Univ., Ser. Mat. Nauk; 31: No. 381, 146-153(1975). (In Russian)

The variable polarization was observed in eclipsing binaries VW Cep and RW Tau. In both stars the variations of polarization at primary minima are similar to Sobolev–Chandrasekhar's effect. (auth)

10019 EVOLUTION OF CLOSE BINARIES IN A STAR FIELD. Agekyan, T. A.; Anosova, Kh. P. Uch. Zap. Leningrad. Gos. Univ., Ser. Mat. Nauk; 31: No. 381, 174-181(1975). (In Russian)

It is shown by the Monte-Carlo method that the major axis of a close binary system is a nonstationary random function with decreasing mathematical expectation. This is due to the interaction with field stars. (auth)

10020 NUMERICAL EXPERIMENTS OF THE EFFECT OF MULTIPLICITY OF STELLAR ENCOUNTER. Petrovskaya, I. V.; Yakimov, S. P. Uch. Zap. Leningrad. Gos. Univ., Ser. Mat. Nauk; 31: No. 381, 182-191(1975). (In Russian)

A method is proposed for investigation of the effect of multiplicity of stellar encounters by numerical experiments. The method is used to find the coefficient of multiplicity of stellar encounters in open clusters. (auth)

10021 EXTREMAL STATES OF MATTER IN ASTROPHYSICS. I. Superfluidity and Superconductivity: Physical Aspects. Borczuch, M. S.; Kuchowicz, B. (Instytut Fizyki Politechniki, Warsaw). Postepy Astron.; 23: No. 2, 111-130(1975). (In Polish)

Such states of matter which are produced under very artificial conditions in the physical laboratory may occur often in the astrophysical universe. The main physical ideas associated with the superfluid and superconducting states of matter (which may occur in pulsars and white dwarfs) are outlined. (auth)

10022 CALCULATION OF THE PROFILES OF SPECTRAL LINES FORMED IN A SCATTERING ATMOSPHERE. Nagirner, D. I. Uch. Zap. Leningrad. Gos. Univ., Ser. Mat. Nauk; 31: No. 381, 3-99(1975). (In Russian)

Multiple scattering of resonance radiation in semiinfinite atmosphere is considered under the following assumptions: two-level atoms; the complete frequency redistribution; the Milne-Eddington model. The tables are given of the functions in terms of which profiles of emission and absorption lines formed in such an atmosphere are expressed. (auth)

10023 DISCOVERY OF A CORONA AROUND AN EARLY-TYPE STAR AND THE PROBLEM OF MASS LOSS. Rogerson, J. B. Jr.; Lamers, H. J. G. L. M. (Princeton Univ., NJ). Nature (London); 256: No. 5514, 190(17 Jul 1975).

Reference is made to the star τ Sco (HD149438). This star is of spectral type BO V, and was studied spectroscopically using the Princeton telescope-spectrometer carried by the Copernicus satellite. It is one of the few early type stars having a small projected rotational velocity. The spectrum showed a few very wide absorption lines, identified as belonging to O VI, N V, and Si IV, and probably originating in the expanding outer layers of the star's atmosphere. It was considered that the strong presence of O^{5+} and N^{4+} ions in the outer layers of the star is surprising; to produce these highly ionized atoms the temperature in the outer layers must be of the order of 1 to 5×10^5K. The temperature of the atmosphere of the star must decrease with height in the photosphere, pass through a minimum in the higher layers, and then again increase to at least a few hundred thousand ^{0}K. A similar temperature structure occurs in the solar atmosphere. The large temperature is due to the dissipation of mechanical energy in the form of acoustic waves in the lower chromosphere, and possibly by Alfven waves in the corona. A possible mechanism for generating this mechanical energy is discussed. The high temperature region, referred to as a corona, around early type stars, may provide a clue to the understanding of mass loss from hot stars. (UK)

10024 NOTE ON THE NEAR-INFRARED ABSOLUTE MAGNITUDE OF IRREGULAR CARBON VARIABLES. Baumert, J.H. (Department of Physics and Astronomy, University of North Carolina, Chapel Hill, NC 27514). Astrophys. J. Lett. 200: No. 3, L141-L141 (15 Sept 1975).

An apparent discrepancy between the results of Peery and Baumert on the mean absolute magnitude at 1.04 μ of irregularly variable carbon stars is resolved. The mean absolute magnitude of this group of stars derived through a statistical analysis of their proper motions and radial velocities is -4.2 ± 0.7 (m.e.). (auth)

10025 AN UNUSUALLY STRONG RADIO OUTBURST IN ALGOL: FLUX DENSITY, SPECTRAL, AND POLARIZATION OBSERVATIONS. Gibson, D.M. (University of Virginia and National Radio Astronomy Observatory); Viner, M.R.; Peterson, S.D. Astrophys. J. Lett. 200: No. 3, L143-L145 (15 Sept 1975).

We have monitored the largest radio outburst to date from the binary β Per (Algol). The observations, made at frequencies of 1400, 2695, 6000, and 8085 MHz, mark the first time a non-X-ray radio binary has been observed at flux densities exceeding 1 Jy. The outburst probably consisted of two Algol-type flares. The radio spectrum remained essentially constant throughout the outburst, and no polarization was detected. (auth)

10026 DETECTION OF THE [Fe XIV] 5303 Å CORONAL LINE IN THE SUPERNOVA REMNANT VELA X. Woodgate, B.E. (Columbia Astrophysics Laboratory, Columbia University); Angel, J.R.P.; Kirshner, R.P. Astrophys. J. 200: No. 3, 715-718 (15 Sept 1975).

The coronal line [Fe XIV] 5303 Å has been detected in Vela X at a statistical significance above zero of 6.3 σ with a flux $(3.9 \pm 0.6) \times 10^{-12}$ ergs $(cm^2\ s)^{-1}$ in a 1° diameter field. This demonstrates that the X-ray flux of Vela X is of thermal origin. The 3 σ upper limits for the [Fe XIV] 5303 Å and [Ar XIV] 4412 Å coronal line fluxes from the supernova remnant Puppis A are respectively 4×10^{-12} and 2.6×10^{-12} ergs $(cm^2\ s)^{-1}$. (auth)

10027 INVARIANCE PRINCIPLES AND INTERNAL RADIATION FIELDS IN SEMIINFINITE ATMOSPHERES. Ivanov, V.V. (Astronomical Observatory, A. A. Zhdanov Leningrad State University). Sov. Astron.—AJ 19: No. 2, 137-141 (Sept 1975).

Some new invariance principles are formulated for the calculation of radiation fields in semiinfinite atmospheres. As special cases they yield the previously known invariance relations, and also a number of new results. One of them is a doubling formula in the problem of diffuse reflection: Given the intensity at depth τ one can, by simple integration and without any iteration or solution of equations, obtain the intensity at depth 2τ. (auth)

10028 EVOLUTION OF MASSIVE STARS. Varshavskii, V.I.; Tutukov, A.V. (Radio Astrophysical Observatory, Academy of Sciences of the Latvian SSR). Sov. Astron.—AJ 19: No. 2, 142-145 (Sept 1975).

A study is made of the structure and evolution of $16/\mathfrak{h}_\odot$, $32/\mathfrak{h}_\odot$, and $64/\mathfrak{h}_\odot$ stars with initial chemical composition $X=0.602$, $Y=0.354$, and $Z=0.044$ ($X_{12}=0.00619$ and $X_{16}=0.01847$) from the start of the main sequence until complete burnup of oxygen in the core of a red supergiant. The evolutionary track of the star during the helium burning stage in the core is determined by the condition of equilibrium in the zone of variable composition, and in later stages by energy losses due to neutrino radiation. In the absence of neutrino radiation, the outer convective envelope penetrates into the region occupied by the former hydrogen and helium shell sources, and this can lead to appreciable anomalies of the chemical composition on the surface of the star and to a reduction in the mass of the carbon–oxygen core. Allowance for neutrino energy losses complicates the structure of the shell sources and the star itself and greatly accelerates the evolution. An estimate is made of the content of helium, carbon, and oxygen in the interstellar medium after a lifetime of the Galaxy resulting from the evolution of massive stars. Some consequences of rotation and the meridional circulation due to it are considered. An investigation is made of the structure and evolution of hydrogen–helium massive stars until the ignition of carbon in the core. (auth)

10029 PULSATIONAL STABILITY OF STARS WITH NEUTRINO THERMAL CONDUCTIVITY. Zentsova, A.S.; Nadezhin, D.K. (Institute of Applied Mathematics, Academy of Sciences of the USSR). Sov. Astron.—AJ 19: No. 2, 146-150 (Sept 1975).

A study is made of the problem of the pulsational stability of hot neutron stars that are opaque to electron neutrinos. Such stars arise as a result of the gravitational collapse of massive stars that have exhausted their sources of nuclear energy. Due to the inverse dependence of the neutrino opacity on the temperature conditions favorable for the excitation of pulsations arise. An expression is obtained for the integral of pulsational stability with allowance for diffusion of the lepton charge. The Galerkin–Ritz method is used to determine the pulsational characteristics of stars and calculate the stability integral. Neutrino thermal conductivity facilitates the excitation of pulsations. However, if the central temperature is lower than $(2\text{–}3) \cdot 10^{11}$°K, pulsations may not be excited because of the damping role of volume emission of muon neutrinos. At higher central temperatures, the star also becomes opaque to muon neutrinos. The damping effect of volume emission of the muon neutrinos is removed, and the star must become pulsationally unstable. (auth)

10030 SELF-CONSISTENT FIELD METHOD IN THE THEORY OF ROTATING STARS. Blinnikov, S.I. (P. K. Shternberg State Astronomical Institute). Sov. Astron.—AJ 19: No. 2, 151-156 (Sept 1975).

A variant of the self-consistent method for calculating arbitrarily rotating models of stars is described. It is more direct and simpler for programming and requires smaller storage space in a computer memory than the variant of Ostriker and Mark.[11] Tables of parameters are given for rigidly rotating $n=1.5$ and $n=3$ polytropes and the results are compared with those of other authors. The accuracy of the energy method of investigating the stability of rotating stars is verified for polytropic isentropic models. It is found that if $n>3.05$ rigid-body rotation cannot stabilize such stars. It is shown that there exist stable, relatively small perturbations of a rotating model with positive total energy. The critical values of the discontinuity for the loss of stability are found for a power equation of state with phase transition: $q=1.33$ ($n=1.5$), $q=1.20$ ($n=2$), $q=1.09$ ($n=2.5$). The critical parameters of differentially rotating white dwarfs with neutronization are calculated. The results are compared with those of refs. 13 and 23. It is shown that the mass of a differentially rotating stable white dwarf hardly exceeds $\sim 2M_\odot$. It is noted that the possible occurrence of turbulence strongly reduces the probability of observation of such white dwarfs. (auth)

10031 NARROW-BAND PHOTOELECTRIC OBSERVATIONS OF THREE SPECTROSCOPIC BINARIES OF WOLF-RAYET TYPE: HD 211853, 190918, 192641. Cherepashchuk, A.M. (P. K. Shternberg State Astronomical Institute). Sov. Astron.—AJ 19: No. 2, 157-159 (Sept 1975).

In the system HD 211853 (WN6+B0I) eclipses were found in the continuum at λ 4789 ($\sim 0^m.1$) and in the emission line He II 4684 ($\sim 0^m.4$); the inclination of the orbital plane is $i=64\text{–}71°$ and the mass of the WN6 star is $(9.5\text{–}13.5)M_\odot$. In the systems HD 190918 and HD 192641 eclipses were not observed. In the system HD 192641 physical fluctuations in the light were observed and their rms amplitudes were $0^m.015$ and $0^m.020$ for the continuum and the intensity of the emission band CII–CIV, N III λ 4653, respectively. (auth)

10032 PROCESS OF STAR FORMATION AND DISCRETENESS OF THE DISPERSIONS OF STAR VELOCITIES. Kaplan, S.A.; Shatsova, R.B. (Gor'kii Radiophysics Institute). Sov. Astron.—AJ 19: No. 2, 160-162 (Sept 1975).

The formation of stars in spiral arms due to preliminary compression of the interstellar gas during intersections of spiral shock waves must lead to discreteness and multiplicity of the dispersions of velocities of the stars which were formed in the same gas-dust complex. The observational data collected in Tables 1-3 confirm the discrete nature of the dispersions of space velocities of a series of groups of stars, both dwarfs and giants, which belong to the extreme Population I, Population I, disk, and intermediate subsystems. The dispersions of space velocities of the stars are multiples of ~10 km/sec. Some scatter of the dispersions of velocities of the stars in the tables can be explained by the scantiness of the samples, observational selection, and a partially remaining inhomogeneity of the groups in an astrophysical sense. (auth)

10033 SOME THEOREMS IN STELLAR STATISTICS AND THE COLOR-EXCESS "PARADOXES". Radzievskii, V.V. (Gor'kii Teachers' College). Sov. Astron.—AJ 19: No. 2, 182-184 (Sept 1975).

Several theorems are proved concerning the arithmetic mean apparent magnitudes and color excesses of stars for various models of the space density distribution of stars and interstellar dust. (auth)

10034 GRAVITATIONAL INSTABILITY IN ROTATING SYSTEMS WITH RADIAL PERTURBATIONS. Genkin, I.L.; Safronov, V.S. (Astrophysical Institute, Academy of Sciences of the Kazakh SSR, Alma-Ata). Sov. Astron.—AJ 19: No. 2, 189-194 (Sept 1975).

Conditions for the development of gravitational instability through radial perturbations are established for four models of a rotating system; an unbounded homogeneous medium, an infinitely thin disk, and a layer of finite thickness with solid-body or Keplerian rotation. The dispersion relations for the finite layer and the thin disk are quite different. The minimum density for onset of instability if $\rho_{cr} \simeq 2\rho^*$, where $\rho^* = 3M/4\pi R^3$ (here M denotes the mass within a sphere of radius R), and the critical wavelength $\lambda_{cr} = 8H$, where H represents the characteristic thickness of the disk. Explanations are given for the substantial differences in the values of ρ_{cr} estimated by various authors. (auth)

10035 DYNAMICS OF A FLARE CURRENT SHEET. I. DIFFUSION THICKENING AND ESTIMATED FLARE PARAMETERS. Pustil'nik, L.A. (Special Astrophysical Observatory, Academy of Sciences of the USSR). Sov. Astron.—AJ 19: No. 2, 195-199 (Sept 1975).

The process of magnetic-field dissipation in the current sheet of a solar-type flare is analyzed. Because of plasma turbulence, dissipation during the flare should take place through a splitting of the current sheet, followed by a diffusion thickening of the sheet. When the rate of thickening balances the rate of contraction due to outflow of plasma through the ends of the sheet, a steady equilibrium state will be established. It is noteworthy that the arrival velocity of the magnetic field at the current sheet, and thereby the power and duration of the flare energy release, here depend solely on the parameters of the undisturbed plasma near the flare. Corresponding estimates are obtained for the basic properties of a flare. This energy-release mechanism circumvents the difficulties with previous models concerning the accumulation of plasma in the current sheet. It can probably be employed to interpret the flare activity observed in a wide variety of objects, including solar chromospheric flares, UV Ceti Stars, x-ray sources, galaxy nuclei, and quasars. (auth)

10036 CORRELATION OF GRAVITATIONAL FORCE IN A HOMOGENEOUS STELLAR SYSTEM. Terebizh, V.Yu. (P. K. Shternberg State Astronomical Institute, Southern Station). Sov. Astron.—AJ 19: No. 2, 268-269 (Sept 1975).

Correlation matrices were found for the components of gravitational force produced by randomly distributed field stars. (auth)

10037 TEST BODIES UNDER THE EFFECT OF GRAVITATIONAL RADIATION. Rudenko, V.N. (Physics Faculty, Moscow State University). Sov. Astron.—AJ 19: No. 2, 270-271 (Sept 1975).

The variations of the orbit of a test body are calculated for motion in a central field under the effect of resonance gravitational radiation. The application of this effect to detection of gravitational waves at frequencies that are typical of binary stars is discussed. Test-body orbit perturbations produced by the gravitational radiation of known binaries are too small to be detected. The detectable energy density of gravitational radiation is estimated. (auth)

10038 SHOCK WAVES IN STELLAR ATMOSPHERES. Kuan, P. (Kitt Peak National Observatory). Astrophys. J. 200: No. 3, 653-659 (15 Sept 1975).

A series solution is found for the propagation of a blast wave in a planar atmosphere with exponentially decreasing density. A perfect gas and adiabatic motion are assumed, and gravity is ignored. The solution is good within about 3 scale heights from the origin of the blast. However, it is within this region that most of the energy of the blast is dissipated in a dense shell, and in particular, approximately 40 percent of it as kinetic energy of the shell. If the velocity gained by the shell is greater than an escape velocity of about 300 km s^{-1}, within the first few scale heights, radiative cooling is unimportant and the assumption of adiabaticity can be justified. If the T Tauri stars are ejecting mass through blast waves set off in their atmospheres, the maximum mass loss rate is estimated to be about $8 \times 10^{-7}\ M_{\odot}\ yr^{-1}$, a value a few times larger than those observed. (auth)

10039 STELLAR MODEL CHROMOSPHERES. III. ARCTURUS (K2 III). Ayres, T.R.; Linsky, J.L. (Joint Institute for Laboratory Astrophysics, University of Colorado and National Bureau of Standards, Boulder). Astrophys. J. 200: No. 3, 660-674 (15 Sept 1975).

We construct models for the upper photosphere and chromosphere of Arcturus based on the H, K, and IR triplets lines of Ca II and the *h* and *k* lines of Mg II. The chromosphere model is derived from complete redistribution solutions for a five-level Ca II ion and a two-level Mg II ion. A photospheric model is derived from the Ca II wings using first the "traditional" complete redistribution limit and then the more realistic partial redistribution approximation. In particular, the temperature and mass column densities for the temperature minimum region and the chromosphere-transition region boundary are computed and the pressure P_0 in the transition region and corona estimated. We find $T_{min}/T_{eff} \simeq 0.77$ for Arcturus, Procyon, and the Sun and a trend of increasing mass at the temperature minimum with decreasing gravity. We find P_0 to be about 1 percent of the solar value, and on this basis estimate the surface brightness of the Arcturus transition region and coronal spectrum to be much less than for the Sun. Finally, the partial redistribution calculation for the Ca II K line indicates that the emission width is at least partially determined by damping rather than Doppler broadening, suggesting a reexamination of previous explanations for the Wilson-Bappu effect. (auth)

10040 THE $^{12}C/^{13}C$ RATIO IN STELLAR ATMOSPHERES. V. TWELVE K GIANTS AND SUBGIANTS. Dearborn, D.S.P.; Lambert, D.L.; Tomkin, J. (McDonald Observatory and Department of Astronomy, University of Texas, Austin). Astrophys. J. 200: No. 3, 675-681 (15 Sept 1975).

High resolution photoelectric scans of portions of the CN red system in the spectra of 12 K giants and subgiants have been analyzed for the $^{12}C/^{13}C$ abundance ratio with the following results: >50(δ Eri), >30(η Cep), 51 ± 5 (ν^2 CMa), 24 ± 3 (γ Cep), 34 ± 4 (53 Eri), 16 ± 2 (*i* Cep), 12 ± 2 (θ Cet), 22 ± 2 (λ Sgr), 20 ± 2 (ξ Dra), 15 ± 2 (ρ Boo), 18 ± 2 (δ Sgr), and 25 ± 2 (δ And). This sample of stars have relatively low absolute luminosities ($\log L/L_{\odot} < 2.1$). Stellar evolution calculations predict that their atmospheres will contain an overabundance of ^{13}C as a result of a convective envelope which has brought to the surface ^{13}C produced in the interior during main-sequence burning. The ^{13}C is observed in all except the two faintest stars. Interpretations of the observed range of results, $5 < {}^{12}C/{}^{13}C < 55$, for giants and subgiants are discussed. (auth)

10041 THE EFFECT OF COMPOSITION CHANGES ON EVOLUTIONARY TRACKS OF DOUBLE-SHELL MODELS. Scalo, J.M. (California Institute of Technology); Ulrich, R.K. Astrophys. J. 200: No. 3, 682-687 (15 Sept 1975).

Evolutionary tracks of double-shell stellar models are computed using a core-envelope fitting technique. Uncertainties in the continuous and molecular contributions to the mean opacity are investigated. A polynomial expression for the Rosseland mean cyanogen opacity is given. We find that variations in the carbon and oxygen abundances greatly affect the position of models in the H-R diagram, the effect being much larger for carbon stars than oxygen stars. (auth)

10042 THE TEMPERATURE AND SPECTRUM OF VX AQUILAE. Greene, A.E.; Wing, R.F. (Perkins Observatory, The Ohio State and Ohio Wesleyan Universities). Astrophys. J. 200: No. 3, 688-693 (15 Sept 1975).

The spectrum of the red variable VX Aql contains strong CN bands and falls in the intermediate SC category between types S and C. A careful attempt to detect bandheads of ZrO and C_2, involving the comparison of computed CN spectra with tracings of image-tube spectrograms, gave negative results. We interpret this to mean that the abundances of oxygen and carbon are more exactly balanced in VX Aql than in most other SC stars, which show either weak ZrO or weak C_2 bands. Thus VX Aql provides a link between these two subgroups of SC stars, supporting the view that they are all part of a continuous sequence of stars ranging from the S stars to the carbon stars, in which the variable is the oxygen/carbon ratio. Other interesting spectral characteristics include the great strength of the Li I, CaH, and CaCl features and the presence of the Merrill-Sanford bands, which have previously been found only in carbon stars; all of these features are strongly favored by high pressure as well as by low temperature. The color temperature and CN strength of VX Aql have been measured by narrow-band photometry in the near-infrared. The color temperature, after correction for the estimated amount of interstellar reddening, ranges from 2450 to 1920 K, lower than for any other known SC star. The large observed range in temperature and infrared magnitude, as well as the appearance of hydrogen emission lines, supports the suggestion that the star is a Mira variable. (auth)

10043 THE VERY SLOW NOVA He 3-558. Henize, K.G. (Lyndon B. Johnson Space Center, Houston); Liller, W. Astrophys. J. 200: No. 3, 694-697 (15 Sept 1975).

The emission-line object He 3-558 has been found to be a very slow nova which rose to maximum brightness in 1948 and which is probably still fading. We describe its spectrum and light curve and derive a distance of 3.5 kpc. No sign of an earlier outburst was found in the Harvard collection of photographs. (auth)

10044 THE EVOLUTION OF SUPERNOVA REMNANTS. IV. THE SUPERNOVA EJECTA. Chevalier, R.A. (Kitt Peak National Observatory). Astrophys. J. 200: No. 3, 698-708 (15 Sept 1975).

A model for Cas A based on the properties of the fast moving knots is investigated. The knots form during or soon after the supernova explosion. They become immersed in hot gas, which heats the knots by thermal conduction provided radiative cooling by overabundant heavy elements is not too strong. The heating time scale is of the same order as or less than the age of Cas A. As a supernova remnant evolves, both the heated ejecta and the interstellar medium emit X-rays. The central X-ray source in the Cygnus Loop may be heated ejecta. The relevance of the model for other supernova remnants is considered. It is likely that the supernova ejecta are eventually mixed through the hot, low-density interior of a supernova remnant. Cooling of the hot gas can occur on a time scale of order 10^5–10^6 years because of the heating, radiative, and dynamical effects due to conduction at the interface with an interstellar cloud. The effect of the expansion of a young remnant on oxygen recombination is investigated and found to be important at low densities. Such effects must be taken into account in attempting to derive abundances from X-ray lines, once they can be measured observationally. (auth)

10045 THE He II LINES IN THE SPECTRUM OF ZETA PUPPIS. Snijders, M.A.J.; Underhill, A.B. (Laboratory for Optical Astronomy, Goddard Space Flight Center, Greenbelt, Maryland). Astrophys. J. 200: No. 3, 634-640 (15 Sept 1975).

Equivalents widths of He II lines in the series $n = 2, 3, 4$ and 5 are compiled and compared with predictions from plane-parallel, static model atmospheres using a non-LTE theory of line formation. The agreement between observation and prediction for a (50,000,4.0) model atmosphere is good for the upper members of the $n=3$ and the $n=5$ series, but the two lines of the $n=2$ series which are observed and the upper members of the $n=4$ series ($4 \rightarrow 15, 4 \rightarrow 17$, etc.) are stronger than predicted. Well-determined profiles of lines from the $n=3$ series indicate $v \sin i = 200$ km s^{-1}. Profiles of the higher members of the $n=4$ series, however, do not match the predictions, the observed line cores being deeper than predicted. The $n=4$ level appears to be more overpopulated at moderate depths in the atmosphere than the non-LTE calculations with plane-parallel layers indicate. This may be due to an overlap of the H and He II lines in the even-even series caused by macroturbulent velocities of the hydrogen atoms and helium atoms. (auth)

10046 ARE STELLAR FLARES ENERGIZED BY THE MISSING ENERGY IN STARSPOTS?. Mullan, D.J. (Bartol Research Foundation of the Franklin Institute, Swarthmore, Pennsylvania 19081). Astrophys. J. 200: No. 3, 641-645 (15 Sept 1975).

We suggest that the energy released in stellar flares is provided by a steady accumulation of a fraction of the missing energy in starspots. The mechanism by which the missing energy might be converted to flare-compatible form is not discussed here. However, the principal result of the paper, equation (9), is independent of the (speculative) details of the conversion and storage mechanisms. The rate of occurrence of flares of absolute magnitude M_f on a star of absolute visual magnitude M_v is found to be $R = \exp[a\ (M_f - M_0)]$ per hour, where $a = 0.92$ independent of stellar type, and $M_0 = 0.7\ M_v$ plus other terms depending on the starspot area. The time T_c required for optically thick flare plasma to cool by recombination radiation is shown to depend on M_v according to $\log T_c \simeq -\gamma M_v$, where $\gamma = 0.05$–0.12, and on the gravity g according to $\log T_c \simeq -\epsilon \log g$, where ϵ may be arbitrarily large depending on the mass-radius relation. These results are in excellent agreement with the observed statistical

properties of stellar flares over a range of almost 10 mag in M_v. The formulae are even applicable in an approximate way to sunspots and solar flares, indicating that solar and stellar flares are probably not caused by radically different mechanisms. The lack of flare stars at spectral types earlier than K0 is interpreted to mean that starspots become very small in the late G stars. According to our starspot hypothesis, this suggests that the transition from deep to shallow convective envelopes occurs at a much later spectral type than is customarily believed. (auth)

10047 SUPERNOVA 1972e IN NGC 5253. Kirshner, R.P.; Oke, J.B. (Hale Observatories, California Institute of Technology, Carnegie Institution of Washington). Astrophys. J. 200: No. 3, 574-581 (15 Sept 1975).

New absolute energy distributions of the Type I supernova 1972e in NGC 5253 extending to about 700 days after maximum light have been obtained. A physical model of the expanding envelope, based on the identification of the feature at 6550 Å with Hα, is proposed. It consists of a differentially expanding atmosphere, with electron density ranging from 10^{10} near maximum light to about 10^7, 340 days later, illuminated by a photosphere with temperature in the range 10,000 K to 7000 K. Under these conditions, the identifications of Ca II λ8600 and H and K, the Na D lines, and the Mg I *b* lines forming P Cygni lines are quite plausible. More than 200 days after maximum, the spectrum is dominated by four features between 4200 and 5500 Å. Three of these four features match the blended emissions from over 100 lines of [Fe II]. If this identification is correct, the envelope requires about 10^{-2} $M_\odot$ of iron, which corresponds to an Fe/H ratio about 20 times higher than the cosmic abundance. Possible identifications of the fourth feature with Mg I λ4571 or permitted lines of Fe II are also discussed. (auth)

10048 EFFECT OF BINARY STARS ON THE DYNAMICAL EVOLUTION OF STELLAR CLUSTERS II. ANALYTIC EVOLUTIONARY MODELS. Hills, J.G. (Department of Astronomy, The University of Michigan, Ann Arbor, Michigan). Astron. J. 80: No. 12, 1075-1080 (Dec 1975).

We use analytic models to compute the evolution of the core of a stellar system due simultaneously to stellar evaporation which causes the system (core) to contract and to its binaries which cause it to expand by progressively decreasing its binding energy. The evolution of the system is determined by two parameters: the initial number of stars in the system N_0, and the fraction f_b of its stars which are binaries. For a fixed f_b, stellar evaporation initially dominates the dynamical evolution if N_0 is sufficiently large due to the fact that the rate of evaporation is determined chiefly by long-range encounters which increase in importance as the number of stars in the system increases. If stellar evaporation initially dominates, the system first contracts, but as N_c, the number of remaining stars in the system, decreases by evaporation, the system reaches a minimum radius and a maximum density and then it expands monotonically as N_c decreases further. Open clusters expand monotonically from the beginning if they have anything approaching average Population I binary frequencies. Globular clusters are highly deficient in binaries in order to have formed and retained the high-density stellar cores observed in most of them. We estimate that for the system $f_b \leq 0.15$. (auth)

10049 THE SPECTRA OF AE ANDROMEDAE AND THE HUBBLE-SANDAGE VARIABLES IN M31 AND M33. Humphreys, R.M. (University of Minnesota, Minneapolis). Astrophys. J. 200: No. 2, 426-429 (1 Sept 1975).

Image-tube spectrograms at 83 Å mm^{-1} and 90 Å mm^{-1} have been obtained of AE And and the Hubble-Sandage variables AF And (variable 19 in M31) and variables B, C, and 2 in M33. The spectra of these extragalactic supergiants are described in detail in the paper. The spectra of all five stars have a strong, hot continuum with no Balmer discontinuity. The emission-line spectrum of AE And is very much like η Car, and it is suggested that all five stars may be related to objects like η Car and S Dor. (auth)

10050 THE PULSE SHAPE OF THE CRAB NEBULA PULSAR, PSR 0531+21, IN THE *V* AND *I* BANDS. Groth, E.J. (Joseph Henry Laboratories, Physics Department, Princeton University). Astrophys. J. 200: No. 2, 278-280 (1 Sept 1975).

Data obtained through *V* and *I* filters indicate that the leading edge of the interpulse of the Crab pulsar is brighter in *V* than in *I* relative to the rest of the pulse shape. In terms of amplitude, the excess is ~2 percent of the main pulse peak, and in terms of energy the excess is 4.4±0.9 percent of the energy contained in the interpulse. Muncaster and Cocke found a similar result in comparing *U* and *V* pulse shapes. In addition to the change in the interpulse, the leading edge of the main pulse may be fainter in *V* than in *I* by ~1 percent of the main pulse peak. The *V* and *I* pulses arrive simultaneously within 12 μs at 95 percent confidence. (auth)

10051 SUPERFLUIDITY IN NEUTRON STARS. I. STEADY-STATE HYDRODYNAMICS AND FRICTIONAL HEATING. Greenstein, G. (Amherst College, Amherst, Massachusetts). Astrophys. J. 200: No. 2, 281-297 (1 Sept 1975).

This paper describes the steady-state hydrodynamic response of the superfluid interior of a neutron star to the decelerating torque responsible for the slowing-down of pulsars. This torque throws the superfluid into a differential rotation, constant on cylinders but varying with distance from the axis of rotation, plus an exceedingly slow circulation in the $\hat{r}$ and $\hat{z}$ directions. This circulation is qualitatively similar to the meridional circulation found in "ordinary" stars. The motion of the superfluid does not lead to a tangling of the vortex lines threading it. The superfluid slows at the same rate as the pulsar. Cylinders of fluid which penetrate below the crust rotate essentially as a rigid body, and at essentially the same rate as the crust. The same is true of the cylinders which remain within the crust if its temperature (the internal temperature of the pulsar) exceeds $\sim 10^8$ K. For temperatures below this value this portion of the superfluid is in strong differential rotation and rotates significantly more rapidly than the crust. In this regime the superfluid angular velocity depends exceedingly sensitively on temperature: it increases by several orders of magnitude if the temperature drops by a factor of 2. Such flows with strong differential rotation may be subject to hydrodynamic instabilities. However, the question of whether a given pulsar is or is not in differential rotation depends very sensitively on quantities known only roughly; the superfluid energy gap, the opacity of the surface layers of the star, and details of the stellar model. Adopting representative values of these parameters, we arrive at the following tentative conclusions. At the relatively high temperatures expected of the Crab pulsar the superfluid everywhere rotates essentially as a rigid body, and at essentially the same rate as the crust. The same is true of the Vela pulsar unless it is of the very highest mass. On the other hand, the superfluid interiors of all but the lightest long-period pulsars are predicted to be in strong differential rotation and to rotate significantly more rapidly than their crusts. The "rubbing" between superfluid and crust steadily dissipates heat. This process of frictional heating sets a lower limit to the temperatures of the pulsars. These temperatures vary quite slowly with time. All the long-period pulsars are predicted to have essentially the same surface temperature, apart from its variation with mass; the predicted temperatures significantly exceed those expected on the basis of cooling theory. They are such that blackbody radiation is likely to be detectable only from the very closest long-period pulsars. For these pulsars, optical detection is *at least* competitive with X-ray detection. Blackbody X-radiation from young hot pulsars, on the other hand, is detectable at great distances.

As the pulsar ages and cools, a time comes when the torque on the superfluid is no longer sufficient to slow its rotation at the same rate as that of the crust. Beyond this point the motion of the superfluid becomes effectively decoupled from that of the crust. The electromagnetic torque on the star now effectively acts on only part of the star—the crust—which now spins down quite rapidly. It is not inconceivable that this phenomenon has something to do with the apparent turning off of the pulsars. It also leads to the notion that there may exist ultralong—period pulsars. (auth)

10052 THE STRUCTURE OF DQ HERCULIS. Katz, J.I. (Institute for Advanced Study). Astrophys. J. 200: No. 2, 298-305 (1 Sept 1975).

The old nova (1934) DQ Her is a short-period eclipsing binary which also has a regular 71 s oscillation. A reexamination of the data shows no evidence for change in the orbital period. The 71^s period is extraordinarily stable, with $|1/\dot{P}| \simeq 10^{12}$. In analogy with pulsars, this stability indicates that rigid-body rotation is the timing mechanism. A white dwarf with a crystalline core, coupled to the surface by a magnetic field, explains both the timing and the luminosity modulation. The dominant source of optical light is reradiated ultraviolet from the white dwarf. The combination of reradiation by structures rotating with the binary orbit and by matter with a constant configuration gives rise to two terms at differing frequencies whose interference leads to the observed phase shift at eclipse. (auth)

10053 EVOLUTION OF CRYSTALLIZING PURE ^{12}C WHITE DWARFS. Lamb, D.Q. (Department of Physics and Astronomy); Van Horn, H.M. Astrophys. J. 200: No. 2, 306-323 (1 Sept 1975).

We describe the first results of a quantitative exploration of white dwarf evolution for models incorporating an accurate dense plasma equation of state and a full treatment of partial ionization and convection in the envelope. We discuss in detail the results for a 1 $M_\odot$, pure ^{12}C star. The cooing curve and luminosity function deviate appreciably from the behavior predicted by Mestel's cooling theory above $\log(L/L_\odot) \simeq -0.5$ due to neutrino energy losses and below $\log(L/L_\odot) \simeq -3.5$ due to Debye cooling. Crystallization occurs at $\Gamma \simeq 160$, and the effects produced by the release of latent heat are evident. The combined effect of increased heat capacity due to Coulomb interactions and release of latent heat during crystallization increases the stellar lifetime by nearly a factor of 3 in the phases preceding Debye cooling, as expected. Deep convective cooling appears less important than previously thought. Agreement between the theoretical luminosity function and the observational functions derived by Weidemann from

the data of Luyten and of Eggen and Greenstein is generally good, and white dwarf lifetimes determined from the cooling curve are consistent with the ages of white dwarfs in clusters. Resolution of differences between the theoretical discovery function and the number of known white dwarfs at very high and low luminosities may provide new information concerning the distribution and origin of the white dwarfs. The direct effects of crystallization are too small to permit observational detection at present. Debye cooling may offer an indirect test, however, because its effect is dramatic and roughly composition independent. For this, unfortunately, an accurate observational luminosity function down to at least $\log(L/L_\odot) \simeq -5$ appears needed. (auth)

10054 TRANSITION FROM A RED GIANT TO A BLUE NUCLEUS AFTER EJECTION OF A PLANETARY NEBULA. Härm, R.; Schwarzschild, M. (Princeton University Observatory). Astrophys. J. 200: No. 2, 324-329 (1 Sept 1975).

The evolution of two stars, with $0.65\,M_\odot$ and $1.00\,M_\odot$, respectively, has been computed through the transition phase following the rapid dynamical ejection of a planetary nebula by a red giant. This ejection phase was mimicked by a sequence of hydrostatic red-giant models with steadily decreasing mass. The sequence was terminated at the moment of rapid decrease of the previously high pulsational instability. With the starting model thus derived, the constant-mass transition phase was found to last about 6000 years. This time interval is just short enough that the star can start providing the ultraviolet radiation in time to excite the ejected nebula before the nebula completely disperses. (auth)

10055 CHEMICAL COMPOSITION AND THE HERTZSPRUNG GAP. Kinahan, B.F.; Härm, R. (Princeton University Observatory). Astrophys. J. 200: No. 2, 330-335 (1 Sept 1975).

The effect of initial chemical composition on the size and position of the Hertzsprung gap is examined. Evolutionary sequences for stars in the mass range $0.8\,\mathcal{M}_\odot$ to $2.5\,\mathcal{M}_\odot$ with initial chemical composition ranging from $X=0.7$ to 0.9 and $Z=0.001$ to 0.04 have been computed with the Cox-Stewart opacities handled by bicubic interpolation. The models show that chemical composition does not affect the size and position of the Hertzsprung gap to the extent necessary to explain such peculiar color-magnitude diagrams as that of the Large Magellanic Cloud cluster NGC 2209. (auth)

10056 STELLAR COOLING IN GAUGE THEORIES OF WEAK INTERACTIONS. Mikaelian, K.O. (Department of Physics, Pennsylvania State University, University Park). Astrophys. J. 200: No. 2, 336-338 (1 Sept 1975).

We consider a large class of processes leading to stellar energy loss, and derive general rules relating the rates in the ordinary V−A theory to those of renormalizable gauge theories of weak and electromagnetic interactions. In these theories energy loss to both electron-type and muon-type neutrinos is allowed. Assuming μ-e universality, the rates attain their minimum for certain values (approximately realized in the Wingberg model) of the neutral-current couplings. More general results, without the assumption of μ-e universality, are also stated. (auth)

10057 RANDOM GRAVITATIONAL ENCOUNTERS AND THE EVOLUTION OF SPHERICAL SYSTEMS. VI. PLUMMER'S MODEL. Spitzer, L. Jr.; Shull, J.M. (Princeton University Observatory). Astrophys. J. 200: No. 2, 339-342 (1 Sept 1975).

Monte Carlo evolutionary computations for spherical clusters have been extended to a system whose initial state is an $n=5$ polytrope (Plummer's model). Since this initial state has frequently been assumed in such calculations, the resultant model K is useful for intercomparing results obtained with different methods. The initial halo of this model is intermediate between that of the previous models D and F, and as a result both the time to collapse and the rate of growth of the escape rate are intermediate between the corresponding values found for these earlier models. The rate of collapse in all these one-component models is consistent with a relative energy loss of 0.2 percent of the core kinetic energy per relaxation time at the center. The velocity anisotropy in the transition region between the isothermal core and the halo grows rapidly as the collapse accelerates; a gravothermal instability in a system with long mean free paths is qualitatively consistent with this result. (auth)

10058 PERIOD-LUMINOSITY-COLOR RELATIONS AND PULSATION MODES OF PULSATING VARIABLE STARS. Breger, M. (University of Texas at Austin, and McDonald Observatory); Bregman, J.N. Astrophys. J. 200: No. 2, 343-353 (1 Sept 1975).

The periods of δ Scuti, RR Lyrae, dwarf Cepheid, and W Virginis variables have been investigated for their dependence on luminosity, color, mass, and pulsation modes. A maximum-likelihood method, which includes consideration of the observational errors in each coordinate, has been applied to obtain observational period-luminosity-color (P-L-C) relations. Hot and cool δ Scuti stars show different values of the pulsation constant Q. Mean values of 0.022 ± 0.001 and 0.030 ± 0.001 days were derived for these two groups. On the radial pulsation hypothesis, the cool variables pulsate in the fundamental mode, while the hotter variables tend to pulsate in the first and second overtones. Analogous to RR Lyrae stars, the division into different pulsation modes seems to be determined by color. The RR Lyrae variables in several globular clusters are found to obey a P-L-C relation almost identical to theoretical relations. Mean absolute magnitudes differ from cluster to cluster, but are also in excellent agreement with mean absolute magnitudes deduced from the transition period in each cluster. SX Phe, a Population II dwarf Cepheid variable, lies on the extension of the RR Lyrae P-L-C relation. Periods of W Virginis stars also show a dependence on *both* luminosity and color. Our P-L-C relation also fits the 26-day variables. Finally, the coefficients of all the observational and theoretical relations are compared and discussed. (auth)

10059 HYDRODYNAMIC MODELS OF A CEPHEID ATMOSPHERE. II. CONTINUOUS SPECTRUM. Karp, A.H. (Astronomy Program, University of Maryland, College Park). Astrophys. J. 200: No. 2, 354-363 (1 Sept 1975).

The hydrodynamic models of a classical Cepheid computed by Karp have been used to study the continuous spectrum of Cepheids. The structure of each hydrodynamic model was used as a snapshot of the temperature and pressure structure of the atmospheric layers. After using line blocking factors to account for the effect of lines on the spectral energy distributions, broad-band *UBVRI* colors were calculated. The light and color curves of the model reproduce the amplitude and asymmetry observed in Cepheids in this period range. In addition, the (color, T_{eff}) -relations derived from the models were found to agree with those derived independently. It is shown that loops in the ($U-B$, $B-V$) -diagram can be produced by a dependence of the continuous opacity on the electron pressure. Mean colors were computed using different averaging schemes, and it is shown that the intensity mean of the magnitudes best reproduces the colors of the equilibrium model. The location of the equilibrium model in the H-R diagram indicates that the zero point of the Sandage and Tammann period-luminosity relation is too high by 0.2 mag. (auth)

10060 ON THE ABSOLUTE MAGNITUDES OF RV TAURI VARIABLES. Barnes, T.G. III (McDonald Observatory and Department of Astronomy, University of Texas at Austin); DuPuy, D.L. Astrophys. J. 200: No. 2, 364-366 (1 Sept 1975).

Recently DuPuy suggested that RV Tauri variables show evidence for $\sim$1.5 mag of nearly neutral extinction in the visual region. The suggestion is based upon an apparent discrepancy between photometric absolute magnitudes and spectroscopic luminosity classes. We have reexamined the evidence and conclude that no discrepancy exists if the surface gravities of RV Tauri variables are as given by the current calibration of MK luminosity classes. In this case, the photometrically determined period-luminosity relation given by DuPuy correctly represents the luminosities of the variables, and no neutral extinction in the circumstellar envelopes is required. (auth)

10061 COMMENTS ON THE REDISTRIBUTION FUNCTION OF JEFFERIES AND WHITE. Kneer, F. (Fraunhofer-Institut, Freiburg, W. Germany). Astrophys. J. 200: No. 2, 367-368 (1 Sept 1975).

The simplified form of the angle-averaged redistribution function $R^{II}(\nu, \nu)$ for coherent scattering in the atom's frame, suggested by Jefferies and White (1960), is neither normalized nor symmetric. It is shown how these requirements can be met by a simple change, retaining the idea that photons are completely redistributed in the Doppler core and coherently scattered in the line wings. (auth)

10062 STELLAR WINDS DRIVEN BY ALFVÉN WAVES. Belcher, J.W.; Olbert, S. (Department of Physics and Center for Space Research, Massachusetts Institute of Technology). Astrophys. J. 200: No. 2, 369-382 (1 Sept 1975).

We consider the properties of stellar winds in which the dynamic expansion of a corona is driven by Alfvén waves propagating outward along radial magnetic field lines. The constants of motion of such winds can be simply expressed in terms of reference-level parameters near the star. Let V_∞ be the escape velocity at some level r_0 near the coronal base, c the speed of light, and W_0 the energy flux which would arise if the coronal magnetic field H_0 were to be convected outward at the local escape velocity (i.e., $W_0 = 4\pi r_0^{\,2} V_{e0} H_0^{\,2}/8\pi$). Winds in which the acceleration mechanism is due to Alfvén wave pressures alone exhibit streaming velocities at infinity which may vary over the range from $\sim 2.0(cV_{e0})^{1/2}$ to $\sim V_{e0}$, depending on the initial Alfvén-wave energy flux at r_0. The mass fluxes associated with such winds may correspondingly vary over the range from $\sim 0.3\ W_0(V_{e0}/c)$ to $\sim 2.0\ W_0$. We discuss in detail the dynamics of the acceleration mechanism which produces these winds. (auth)

10063 A NON-LTE ANALYSIS OF THE CN 3883 Å BAND HEAD IN THE UPPER PHOTOSPHERE OF ARCTURUS. Mount, G.H.; Ayres, T.R.; Linsky, J.L. (Joint Institute for Laboratory Astrophysics, University of Colorado). Astrophys. J. 200: No. 2, 383-391 (1 Sept 1975).

A detailed non-LTE study of the CN(0,0) 3883 Å band-head spectrum of Arcturus (K2 III) provides an accurate determination of the carbon, nitrogen, and oxygen abundances in Arcturus. Non-LTE effects are significant, and we find that the Ayres-Linsky model provides an adequate fit to the observations for $[C,N]_* = 1/3[C,N]_\odot$ and

$[O]* = 0.60[O]_{\odot}$, or for $[C,N,O]* = 1/6[C,N,O]_{\odot}$, but the latter abundances are unlikely. The upper photospheric microturbuluence is found to be 2.5 ± 0.2 km s^{-1}. (auth)

10064 PHOTOMETRY OF FG SAGITTAE. Fernie, J.D. (David Dunlap Observatory, University of Toronto, Richmond Hill, Ontario, Canada). Astrophys. J. 200: No. 2, 392-394 (1 Sept 1975).

BVRI photometry of FG Sge on seven consecutive nights in 1974 September is reported. The star was definitely variable, but the observations are too concentrated in time to allow suitable comparison with those of Papousek—although, if anything, the present results indicate more rapid variability than found by Papousek. The mean $(B-V)$ of the star has now reached 1.41, which continues the linear trend of $(B-V)$ changes in recent years. The positions of the star on the $(B-V)$ versus $(R-I)$ diagram is peculiar: dereddening the star in the usual way does not place it on the intrinsic sequence of supergiants in this diagram. It is pointed out that the 60^d quasi-periodicity found by Papousek is in good agreement with the suggestion by Christy-Sackmann and Despain that FG Sge has $M_{bol} \simeq -5.5$ and $M \simeq 0.73\ M_{\odot}$. (auth)

10065 THE ULTRAVIOLET SPECTRUM OF GAMMA CYGNI. Johnson, H.M. (Lockheed Missiles and Space Co.). Astrophys. J. 200: No. 2, 395-398 (1 Sept 1975).

These are data of an F8 Ib supergiant in the ranges λλ2558–2600 and λλ2765–2805 at a resolution of 0.4 Å. Line identifications are guided by previous identifications in the range λλ3977–4405. Rare-earth line richness is apparent. Although supernova-companion genesis for rare earths is tenable, there is no demonstrable connection between γ Cyg and the so-called γ-Cygni supernova remnant or nebula. In particular, there is no ultraviolet spectral evidence for mass ejection that might excite the nebula. The Mg II λλ2795–2802 doublet passes from net absorption to net emission in Ib stars around spectral class G0. (auth)

10066 THE OUTER STRUCTURE OF THE CRAB NEBULA. Chevalier, R.A.; Gull, T.R. (Kitt Peak National Observatory). Astrophys. J. 200: No. 2, 399-401 (1 Sept 1975).

Observations of the line emission from the Crab Nebula indicate a structure consisting of dense filaments from which thin clumpy sheets of gas fan out radially. The jet feature noted by van den Bergh is one of these sheets. The sheets may have been created by the differential acceleration of filaments, or they may be the result of the formation of the dense filaments by the Rayleigh-Taylor instability. (auth)

10067 *COPERNICUS* OBSERVATIONS OF INTERSTELLAR ABSORPTION AT LYMAN ALPHA. Bohlin, R.C. (Goddard Space Flight Center, Greenbelt, Maryland). Astrophys. J. 200: No. 2, 402-414 (1 Sept 1975).

Column densities N_H of atomic hydrogen have been derived for 40 OB stars from spectral scans at Lα obtained by the *Copernicus* (OAO-3) satellite. The stars are all between 60 and 1100 pc away with a range of mean densities n_H of 0.01 to 2.5 atoms cm^{-3}. For 27 stars without significant amounts of molecular hydrogen, the mean ratio of gas to color excess is $\langle N_H/E\,(B-V)\rangle = 3.6 \times 10^{21}$ atoms cm^{-2} mag^{-1}, and the mean density is $\langle n_H \rangle = 0.12$ atoms cm^{-3}. For 10 stars where the molecular hydrogen is at least 5 percent of the total hydrogen, $\langle N_H(\text{total})/E\,(B-V)\rangle$ is 5.4×10^{21} atoms cm^{-2} mag^{-1} and $\langle n_H(\text{total})\rangle$ is 0.7 atoms cm^{-3}. In this limited set of data, the ratio of gas to color excess in clouds varies from 1 to 3 times the mean outside of clouds. The presence of molecular hydrogen correlates with $E\,(B-V)$, but the best tracer for H_2 is atomic hydrogen. The mean density of the gas for all 40 stars is much smaller than the mean of 0.7 atoms cm^{-3} obtained from 21-cm observations, because the brightest stars with less than average amounts of matter in the line of sight were selected for observation. (auth)

10068 MASS AND MOMENT-OF-INERTIA PEAKS IN GENERAL RELATIVITY. Adams, R.C.; Warburton, R.D.H. (Physics Department, University of Pennsylvania, Philadelphia); Cohen, J.M. Astrophys. J. 200: No. 2, 263-268 (1 Sept 1975).

The existence of maxima in both the mass and moment of inertia of stellar models is discussed. The moment-of-inertia peak occurs at a lower density than the mass peak. It is shown that general-relativistic effects cause the two peaks to move together as the density increases. Presented is a method (not involving numerical integration) for obtaining the position of the peaks. (auth)

10069 NONEXISTENCE OF EXTREME BLACK HOLES. Voorhees, B. H. (Univ. of Alberta, Edmonton). Nuovo Cim.; 29B: No. 1, 63-70(11 Sep 1975).

It is shown that a regular black hole with stationary initial and final states cannot have an extreme final state if this state is to occur at a finite value of an affine parameter, assuming that this space-time admits a certain test Maxwell field. (auth)

10070 GRAVITATIONAL AND ELECTRIC FIELDS OF A MASSIVE CHARGED SOURCE DESCRIBED BY COMPLEX TETRADS. Smith, P. D. P. (Memorial Univ. of Newfoundland, St. John's). Nuovo Cim.; 29B: No. 1, 71-78(11 Sep 1975).

It was shown recently that the gravitational and electromagnetic fields outside a massive, charged source can be represented by a tensor of mixed symmetry built from complex tetrad fields. It is shown that an explicit form of such tetrads can be found, representing the Nordstom-Reissner gravitational field and the Coulomb electric field outside a massive charged static source. (auth)

10071 NEUTRON STAR MODELS WITH CONDENSED π^- PHASE. Roy, D. (New York Univ., NY). Indian J. Phys.; 49: No. 5, 333-337(May 1975).

Following Sawyer, models of neutron stars with condensed phase at the core were constructed by numerically integrating the differential equation. All such models are unstable. (auth)

10072 LATE STAGES OF STELLAR EVOLUTION: PROCEEDINGS OF THE SYMPOSIUM, WARSAW, POLAND, SEPTEMBER 10–12, 1973. Tayler, R. J.; Hesser, J. E. (eds.). IAU Symposium, No. 66. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974). 277p. $32.25.

Papers are presented dealing with the processes taking place in all classes of stars during the late stages of their evolution. Some of the topics covered include nuclear reactions and neutrinos in stellar evolution, nonexplosive mass loss, presupernovae, the chemical composition of late type stars, nuclei of planetary nebulae, and the case of the missing solar neutrinos. (IAA)

10073 NUCLEI OF PLANETARY NEBULAE. O'Dell, C. R. (Marshall Space Flight Center, Huntsville, AL). pp 213-221 of Late Stages of Stellar Evolution. Tayler, R. J. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on late stages of stellar evolution; Warsaw, Poland (10 Sep 1973).

The nuclei of planetary nebulae are examined both observationally and theoretically. It is seen that the region occupied by these stars in the logT-logL diagram is quite wide but consistent with a general progression of stars from high to low luminosity, with a noticeable but not large increase in luminosity during the early phase. The "evolutionary path" is intrinsically quite wide and may indicate the evolution of stars under different conditions or non-monotonic passage along the mean path. Among the several theoretical approaches to this subject, only the double shell burning models seem to offer enough luminosity and short enough timescales to match the observations. (auth)

10074 CHEMICAL COMPOSITION OF LATE TYPE STARS. Boyarchuk, A. A. (Crimean Astrophysical Observatory, Kiev). pp 198-205 of Late Stages of Stellar Evolution. Tayler, R. J. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on late stages of stellar evolution; Warsaw, Poland (10 Sep 1973).

A discussion of the chemical composition of the atmospheres of various types of late-type peculiar stars is given. Their compositions are compared with those of normal K and M stars. The groups considered include CN, CH, Ba, S, C, R CrB and HdC stars. (auth)

10075 OBSERVATIONAL DATA ON NOVAE AND SUPERNOVAE. Mustel, E. R. (Moscow State Univ.). pp 172-184 of Late Stages of Stellar Evolution. Tayler, R. J. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on late stages of stellar evolution; Warsaw, Poland (10 Sep 1973).

The first half of the paper contains a discussion of the chemical composition of the envelopes of supernovae for the period close to light maximum. It is concluded that the abundance of hydrogen in the envelopes of type I supernovae is low, much lower than that of nitrogen. The abundance of oxygen and carbon is also noticeably lower than that of nitrogen, and it seems that there is plenty of helium and metals in these envelopes. The information for type II supernovae is more limited, but it is quite certain that the abundance of hydrogen in the envelopes of these stars is much higher than in the envelopes of type I supernovae. In the second half of the paper the problem of supernova remnants is discussed. There are reasons to suggest that supernovae as well as novae are double star systems, that they are relatively "old", that they are quite peculiar objects and that they are not the final stage of evolution of "normal" stars. (auth)

10076 PRESUPERNOVAE. Imshennik, V. S.; Nadezhin, D. K. (Inst. of Applied Mathematics, Moscow). pp 130-148 . of Late Stages of Stellar Evolution. Tayler, R. J. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on late stages of stellar evolution; Warsaw, Poland (10 Sep 1973).

Survey of the present state of theories concerned with the mechanism of supernova outbursts is presented. Special attention is paid to the state of the star immediately before the supernova

explosion (presupernova). The following topics are discussed: the thermonuclear model of supernova explosions, the gravitational collapse model of supernova explosions, the characteristics of presupernova models resulting from the comparison of theoretical light curves with observational ones. (auth)

10077 QUASI-NORMAL MODES OF THE SCHWARZCHILD BLACK HOLE. Chandrasekhar, S.; Detweiler, S. (Univ. of Chicago). Proc. R. Soc. (London), Ser. A; 344: No. 1639, 441-452(12 Aug 1975).

The quasi-normal modes of a black hole represent solutions of the relevant perturbation equations which satisfy the boundary conditions appropriate for purely outgoing (gravitational) waves at infinity and purely ingoing waves at the horizon. For the Schwarzschild black hole the problem reduces to one of finding such solutions for a one-dimensional wave equation (Zerilli's equation) for a potential which is positive everywhere and is of short-range. The notion of quasi-normal modes of such one-dimensional potential barriers is examined with two illustrative samples; and numerical solutions for Zerilli's potential are obtained by integrating the associated Riccati equation. (auth)

10078 INTRODUCTION TO ASTRONOMICAL PHOTOMETRY. Golay, M. Astrophysics and Space Science Library. Vol. 41. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974). 375p. $48.40.

General definitions and questions of energy distribution for various spectral types are considered along with photometric measurements, effects of bandwidths and interstellar absorption, the two-dimensional photometric representations of stars, multicolor and wideband photometry, intermediate and narrow passband photometry, and photometric parameters and their correlation with basic parameters describing the physical state of stellar atmospheres. Applications of photometry to various stellar objects are also discussed, giving attention to O star photometry, the photometry of Ap stars, subdwarf photometry, cool star photometry, and the photometry of galaxies. (IAA)

10079 RADIATIVE TRANSFER IN CIRCUMSTELLAR DUST. Harvel, C. A. Gainesville, FL; Univ. of Florida (1974). 98p. University Microfilms Order No. 75-16,390.

Thesis (Ph. D.).

A procedure is developed to calculate the radiation field as a function of position, direction, and wavelength within a spherically symmetric circumstellar dust shell. The dust shell is assumed to consist of grey isotropically scattering dust particles in thermal equilibrium with the radiation field and to be characterized by seven parameters--the radius of the central star, the inner radius of the shell, the outer radius of the shell, the total optical depth of the shell, an index which specifies the density distribution, the albedo of the dust particles, and the temperature of the central star. The temperature distribution and the radiation field within several model dust shells are determined, and used to calculate for each shell the spectral-energy distribution of the radiation emitted. These models are compared to those of other authors. It is found that fitting the visual spectral-energy distribution of an observed object does not necessarily mean that the model parameters so obtained are consistent with the infrared part of the objects' spectral energy distribution, and that the shape of the spectral energy distribution can be strongly dependent on the index in the assumed power law density distribution. The procedure is applied to the new infrared objects--HD 45677 and R Monocerotis. (Diss. Abstr. Int., B)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstracts 9340, 10005, 10013, 10025, 10026, 10035, and 10186.

10080 OPTICAL PHOTOMETRY OF STARS NEAR CEN X-3. Penston, M. J.; Murdin, P. (Royal Greenwich Observatory, Hailsham, Eng.). Mon. Not. R. Astron. Soc.; 172: No. 2, 377-384(Aug 1975).

Upper limits are reported to regular optical pulsations in Cen X-3 of 0.006 mag, and to flickering of 0.01 mag. The large reddening of the source is consistent with the field reddening at a distance of 5-10 kpc, but in view of observational selection in such data, firm conclusions are not made about the absolute magnitude of the primary. (auth)

10081 DECAY OF X-RAY SOURCE A0535 + 26. Kaluzienski, L. J.; Holt, S. S.; Boldt, E. A.; Serlemitsos, P. J. (National Aeronautics and Space Administration, Greenbelt, MD). Nature (London); 256: No. 5519, 633-634(21 Aug 1975).

Earlier studies on the transient x-ray source A0535 + 26 are first summarized, followed by observations on its decay. The overall 3 to 6 keV light curve is shown graphically. When first observed on April 19, 1975, the source was about 15% more intense than the Crab Nebula and stayed at this level for approximately one week. It then decayed and became unobservable. The decay showed a plateau region just after maximum, not unusual for transient sources, although the lifetime was shorter than usual. The only other transient sources reported with comparably short lifetimes are 3U1735-28 and A1118-61, with which the source shares spectral and pulsing similarities. (UK)

10082 HARD X-RAY MEASUREMENTS OF NOVA A0535 + 26 IN TAURUS. Coe, M. J.; Carpenter, G. F.; Engel, A. R.; Quenby, J. J. (Imperial Coll. of Science and Tech., (London). Nature (London); 256: No. 5519, 630-631(21 Aug 1975).

Measurements are described of high energy x-rays in the region of the Crab Nebula by the satellite Ariel V between April 13 and April 29, 1975. During this period the x-ray nova A0535 + 26 was first detected and observed to reach its maximum intensity, the intensity rising to a value considerably brighter than the Crab at 30 keV, making it the brightest known source in the sky. The detection apparatus employed a shielded crystal scintillator, operating in the range 26 keV to 1.2 MeV. The spectra showed some evidence of steepening as the nova brightened. Information on the spectral development is shown graphically. The results can be interpreted in terms of accretion of material from a normal star on to a compact object like a neutron star, and point to a multilayer multitemperature source model, and the relatively constant shape of the spectrum during flare-up of the source is consistent with an accretion model in a binary system. (UK)

10083 OBSERVATIONS OF A0535 + 26 WITH THE LEICESTER SKY SURVEY EXPERIMENT. Ricketts, M. J.; Turner, M. J. L.; Page, C. G.; Pounds, K. A. (Univ. of Leicester, Eng.). Nature (London); 256: No. 5519, 631-633(21 Aug 1975).

Some observations of the source A0535 + 26 subsequent to the earlier observations made during the period April 13 to April 29, 1975, are described, using the Leicester University Sky Survey instrument in single and eight channel modes. It was found possible to extend the earlier Ariel V measurements of intensity to cover the whole period from appearance of the source to June 1, and the data were combined to give a continuous light curve. On May 2 the intensity at 3 to 18 keV was found to be three times that of the Crab. The peak intensity appeared to occur between April 29 and May 2, followed by a slow fall to May 16 and a sharper decrease over the following 15 days. Spectral data are shown graphically and spectral parameters are tabulated, together with parameters for the Crab measured simultaneously. If the spectrum is thermal it seems that the emission region cooled significantly over a 13 day period. Other data show strong low energy attenuation during the rising part of the light curve, indicating that the spectrum changed significantly during evolution of the source. (UK)

10084 OBSERVATIONS OF A TRANSIENT X-RAY SOURCE WITH A PERIOD OF 104 S. Rosenberg, F. D. (Mullard Space Science Lab., Dorking, Eng.); Eyles, C. J.; Skinner, G. K.; Willmore, A. P. Nature (London); 256: No. 5519, 628-630(21 Aug 1975).

It is stated that during routine observations of the Crab Nebula by the satellite Ariel V a new x-ray source was discovered. This is termed A0535 + 26. The source was just detectable during the first observation on April 13, 1975, but during the 16 days of observation it brightened to nearly twice the Crab's intensity. It showed a period of 104 sec., with a very flat spectrum in the 3 to 7 keV range. The behavior of the source was comparable with that of other x-ray transients. The light curve of the source showed no evidence of eclipses. (UK)

10085 MINIMUM SIZE AND MASS OF SOME QUASI-STELLAR OBJECTS. Durgapal, M. C. (Jodhpur Univ., India). J. Phys., A. (London); 8: No. 6, 1014-1018(Jun 1975).

The minimum sizes of four quasi-stellar objects, each of which exhibits an absorption redshift greater than its emission redshift, have been calculated by assuming that the absorption lines originate in clouds which are falling radially towards the quasi-stellar objects along the line of sight, and that the quasi-stellar objects are at a distance inferred from the cosmological interpretation of their redshifts. It has been found that the radii are greater than 10 pc and that the masses are of the order of $10^{12} M_{\odot}$. (auth)

10086 NEW SPECTROMETRIC RESULTS ON THE QUASAR 3C 273. Boksenberg, A. (University Coll., London); Shortridge, K.; Fosbury, R. A. E.; Penstone, M. V.; Savage, A. Mon. Not. R. Astron. Soc.; 172: No. 2, 289-303(Aug 1975).

A systematic spectrometric study of 3C273 has been performed using a digital image tube. This has yielded improved spectra, particularly of the blue region, showing previously undetected

features. A table of emission line equivalent widths is presented and a comparison made with recent photoionization models. The forbidden lines are well fitted by a model with an ion number density of $2 \times 10^8 cm^{-3}$ and our upper limit on the intensity ratio of [Ne v] λ 3426 to [Ne III] λ 3868 gives indirect evidence that the helium to hydrogen ratio is greater than 0.01 by number. The Balmer decrement is considerably steeper than predicted by case B radiative recombination theory but may be explained by including the effects of self-absorption with an optical depth of H_α of about 200. The emission feature previously identified as the sodium D-lines should now probably be attributed to He I. (auth)

10087 EFFECT OF LARGE FIELDS ON THE LIFETIME OF THE FORBIDDEN LINES SEEN IN QUASARS. Ezawa, H.; Leventhal, M. (Bell Telephone Labs., Murray Hill, NJ). J. Phys., B. (London); 8: No. 11, 1824-1830(1 Aug 1975).

Current models of quasars assume the presence of strong magnetic fields. An ion moving in this magnetic field also experiences an electric field in its rest frame. Perturbation by this motional electric field mixes parity so that the forbidden magnetic-dipole transitions can possibly be turned into the much faster electric-dipole transitions. The magnetic field itself also mixes states changing the transition probabilities. It is found (i) that an electric field above about 10^8 V cm^{-1} is required to cause a significant enhancement of the forbidden line intensities in the quasar spectra and (ii) no such effect can be expected from the magnetic field. (auth)

10088 PHOTOGRAPHIC PHOTOMETRY OF THE COMPACT EXTRAGALACTIC OBJECTS. III. Babadzhanyants, M. K.; Vinokurov, S. K.; Gagen-Torn, V. A.; Semenova, E. V. Uch. Zap. Leningrad. Gos. Univ., Ser. Mat. Nauk; 31: No. 381, 100-122(1975). (In Russian)

The results of the photographic observations of the compact extragalactic objects made in 1972 are presented. The nature of the variability of 3C 345, 3C 371, and 3C 390.3 is discussed. (auth)

10089 OBSERVATIONS OF A NEW TRANSITION IN THE EMISSION FROM Cyg X-1. Holt, S. S.; Boldt, E. A.; Kaluzienski, L. J.; Serlemitsos, P. J. (National Aeronautics and Space Administration, Greenbelt, MD). Nature (London); 256: No. 5513, 108-109(10 Jul 1975).

Following reports that the x-ray emission from Cyg X-1 had increased, data from the all-sky monitor aboard the satellite Ariel V were examined to verify that a sudden transition had occurred on April 22, 1975, 9 days before the initial observation of such transitions by the Astronomical Netherlands Satellite (ANS). The all-sky monitor consisted of a pinhole camera sensitive to x-rays in the energy range 3 to 6 keV. The rise on April 22 was verified as real. (UK)

10090 X-RAY OBSERVATIONS OF Cyg X-1 WITH ANS. Heise, J. (Astronomical Inst., Utrecht); Brinkman, A. C.; Schrijver, J. Nature (London); 256: No. 5513, 107-108(10 Jul 1975).

The results of some measurements made with soft and hard x-ray detectors carried by the Astronomical Netherlands Satellite (ANS) are here reported. The measurements were made in May 1975. Cyg X-1 was observed to have undergone an upward transition in intensity that seemed to be the inverse of the downward transition observed by the Uhuru in April 1971. The bulk of the increase appeared to have occurred at low energy; between 1 and 2 keV the increase was by a factor of 10 compared with measurements made by ANS in November 1974, while above 8 keV there was no significant change. Models for the changes are discussed. (UK)

10091 ARIEL V AND COPERNICUS MEASUREMENTS OF THE X-RAY VARIABILITY OF Cyg X-1. Sanford, P. W. (Mullard Space Science Lab., Dorking, Eng.); Ives, J. C.; Burnell, S. J. B.; Mason, K. O.; Murdin, P. Nature (London); 256: No. 5513, 109-111(10 Jul 1975).

Observations are reported on the intensity and spectrum of Cyg X-1 as obtained over the period 3 to 15 May 1975 using the collimated proportional counter on the satellite Ariel V. An integration time of ~30 min. was employed. The data showed that at the beginning of this period Cyg X-1 showed a higher intensity and had a steeper spectrum, and was generally more active, than observed during the previous 2½ years by Copernicus, but towards the end of the period the source seemed to be returning to its lower state. The high and low states observed by Ariel V were similar in intensity and spectral index to those reported by the Uhuru. Cyg X-1 was also observed by Copernicus on a number of occasions between November 1972 and May 1975, and results are compared with those of Ariel V; some differences in spectral index are noted. The implication is that the source was in its low state from April 1, 1971, until May 1, 1975, and in a high state for about 20 days thereafter. It seems that the low state is the usual state of Cyg X-1, in which it remains for about 90% of the time. Mechanisms are discussed. (UK)

10092 HD 206267, A CANDIDATE STAR FOR THE TRANSIENT X-RAY SOURCE CEPHEUS X-4. Hensberge, G. (Amsterdam Univ. (Netherlands). Sterrenkundig Instituut); Hammerschlag, R. H. (Rijksuniversiteit Utrecht (Netherlands). Sterrekundig Instituut). Astron. Astrophys.; 39: No. 1, 157-158(Feb 1975).

The spectrum of the 3.7 day spectroscopic binary HD 206267 shows no evidence for large mass loss. No emission lines could be detected in the wavelength region λλ 3,750-6,680 A. The orbital elements of the system suggest a massive secondary which can be interpreted as a normal non-degenerate star. (auth)

10093 ORBITAL ELEMENTS AND AN ANALYSIS OF MODELS FOR HDE 226868=Cygnus X-1. Bolton, C.T. (David Dunlap Observatory, University of Toronto). Astrophys. J. 200: No. 2, 269-277 (1 Sept 1975).

Radial velocities from 21 new high-dispersion spectrograms of HDE 226868 are presented. These are combined with previously published data to calculate a "definitive" set of orbital elements for the binary system. In particular, archival data are used to obtain a precise period. The ellipsoidal light curve is analyzed using both a Roche model and an ellipsoidal model, and the results are compared with work by Hutchings. Information from the absorption-line and emission-line velocity curves and the light curve is combined to give estimates for the orbital inclination and the component masses. The possible errors in the analysis are discussed and are shown to be negligible. A qualitative model for the mass transfer is proposed that explains the intensity and velocity variations of the optical emission lines and the variations in the X-ray intensity—including the low-energy X-ray absorption events sometimes seen near superior conjunction of the secondary. Tests of this model are also proposed. Finally, the observations are used to test various models that have been proposed for the system. The observations rule out low mass and rotating degenerate dwarf secondaries and present difficulties for the triple star model. The magnetic reconnection model is not ruled out by the observations. Models in which the secondary is a black hole are consistent with all available observations. (auth)

10094 STRONG MOLECULAR LINE EMISSION ASSOCIATED WITH SMALL Hα EMISSION REGIONS. Blair, G.N.; Peters, W.L.; Vanden Bout, P.A. (Department of Astronomy and Electrical Engineering Research Laboratory, The University of Texas at Austin). Astrophys. J. Lett. 200: No. 3, L161-L164 (15 Sept 1975).

A search for new sites of ongoing star formation has been undertaken using Hα emission nebulosity as a guide. The $J=1\text{—}0$ transition of $^{12}C^{16}O$ is used as a probe of the structure of these regions and an indicator of the position of embedded sources. Of the 60 Hα regions surveyed thus far, 30 distinct areas of CO emission enhanced in one or more localized areas have been detected. Several are very strong molecular emission sources. To a distance of 4 kpc, their galactic distribution is similar to that of known protostellar regions containing powerful radio continuum sources. The data suggest that line broadening is present at the position of peak emission in seven sources and that $^{12}C^{16}O$ may be a poorer probe than $^{13}C^{16}O$ for deeply penetrating into molecular clouds. (auth)

10095 DISTRIBUTION OF QUASARS IN THE DEGREE OF LINEAR POLARIZATION AND THE DEGREE OF HOMOGENEITY OF THE MAGNETIC FIELD. Kolobov, V.M.; Sazonov, V.N. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR). Sov. Astron.—AJ 19: No. 2, 169-170 (Sept 1975).

The observed distribution of the number of quasars n as a function of the degree of linear polarization p at 49 cm wavelength is of the form $n(p_l) \sim \exp\{-p_l/\bar{p}_l\}$, where $\bar{p}_l \simeq 1.5\%$. It is shown that such an exponential distribution is given by a model in which the radio-emitting region consists of a large number of segments $N \simeq \bar{p}^{-1}$. In each segment the magnetic field is constant in magnitude and arbitrary in orientation. (auth)

10096 POLARIZATION OF THE RADIO EMISSION OF PULSARS. Onishchenko, G. (Institute of Space Research, Academy of Sciences of the USSR). Sov. Astron.—AJ 19: No. 2, 171-173 (Sept 1975).

The strong linear polarization of the radio emission of pulsar PSR 0833-45 can be accounted for by the effect of an ultrarelativistic magnetoactive plasma in the magnetosphere of the pulsar on the propagation of the radio emission. It is shown that the ultrarelativistic magnetoactive plasma may act as a polaroid for the radio emission in the case of quasitransverse propagation. (auth)

10097 INTENSITY DECREASE OF CASSIOPEIA A AT 13 MHz. Benediktov, E.A. (Gor'kii Radiophysical Institute). Sov. Astron.—AJ 19: No. 2, 267-267 (Sept 1975).

Radio-emission measurements of ionospheric radio-wave absorption at a frequency of 13 MHz have been made at Gor'kii for many years. Diurnal antenna pattern passages of the Cassiopeia A source were recorded. The signal level of the source is about 25% of the cosmic

background radiation level. Data from the autumn months of 1963–1972 were used to determine the secular decrease in source intensity, which amounts to 0.4±0.65% per year. (auth)

10098 ON THE NATURE OF THE GLOBULAR CLUSTER X-RAY SOURCES. Silk, J.; Arons, J. (Department of Astronomy, University of California, Berkeley). Astrophys. J. Lett. 200: No. 3, L131-L135 (15 Sept 1975).

It is suggested that the globular cluster X-ray sources can be interpreted in terms of mass shed by evolving post-main-sequence stars in the central regions of the globular cluster and accreting onto a massive (~ 100–$1000\ M_\odot$) central black hole. Tentative indications that support this hypothesis include the high central escape velocities and the distribution of metallicities among the four globular clusters containing luminous X-ray sources. We argue that these X-ray sources cannot be explained as a consequence of the close capture of a nuclear burning star by a compact stellar remnant. (auth)

10099 NEUTRAL HYDROGEN ABSORPTION IN THE SPECTRUM OF THE QUASAR-GALAXY PAIR 4C 32.33/NGC 3067. Haschick, A.D.; Burke, B.F. (Department of Physics, Research Laboratory of Electronics, Massachusetts Institute of Technology). Astrophys. J. Lett. 200: No. 3, L137-L140 (15 Sept 1975).

Radio spectra near 21 cm wavelength were taken of five close quasar-galaxy pairs. Neutral hydrogen absorption of radiation from the quasar 4C 32.33 (3C 232) has been detected at a velocity ($C\Delta\lambda/\lambda_0$) of 1418 km s^{-1}. This feature lies 76 km s^{-1} away from the velocity of the galaxy NGC 3067 which is separated from the position of 4C 32.33 by less than 2 Holmberg radii. The absorption line has an optical depth, τ, of 0.027±0.005 and a velocity half-width of ≤ 5.5 km s^{-1}. These parameters imply a neutral hydrogen column density $\leq 2.7 \times 10^{17}\ T_s$ cm^{-2}. No absorption features were detected in the sources 3C 268.4, 3C 275.1, 3C 309.1, or 3C 455. The similarity of the absorption feature in 4C 32.33 to that discovered by Brown and Roberts in 3C 286 lends some support to the suggestion by Brown and Roberts that the feature in 3C 286 is caused by a cloud of neutral hydrogen associated with a galaxy somewhere along the line of sight to the quasar. (auth)

10100 VARIABLE RADIO SOURCE STRUCTURE ON A SCALE OF SEVERAL MINUTES OF ARC. Ross, H.N. (Owens Valley Radio Observatory, California Institute of Technology). Astrophys. J. 200: No. 3, 790-802 (15 Sept 1975).

During the course of high-frequency flux-density measurements on sources exhibiting low-frequency cutoffs, at least three such sources, 4C 79.4, 4C 79.15, and PKS 2344+09, revealed structure on a scale ranging from a fraction of a minute of arc to as much as 15 minutes of arc. This structure appears to change significantly on a time scale of several months. It is suggested that this variable structure arises from the existence of several centers that are highly variable in flux density, but fixed in position. (auth)

10101 AN INTERPRETATION OF THE RADIO OUTBURSTS OF CYGNUS X-3. Marscher, A.P. (Astronomy Department, University of Virginia, Charlottesville); Brown, R.L. Astrophys. J. 200: No. 3, 719-726 (15 Sept 1975).

We describe the radio bursts from Cyg X-3 by an expanding cloud of relativistic particles and magnetic fields that is uniformly mixed with an ionized thermal gas. We follow the time evolution of the synchroton radiation from such a cloud including both synchrotron losses and adiabatic losses in the calculation. In the immediate postmaximum period, synchrotron losses dominate and determine the character of the subsequent decay of the burst; this is reflected in an exponential form of the decay near maximum. At later times, adiabatic losses are more important and the later stages of the decay follow a power law; this behavior is in keeping with the observations. The coexpansive thermal gas attenuates the low-frequency radio spectrum via free-free absorption, a process which effectively competes with synchroton self-absorption in determining the optical depth at all frequencies. The agreement obtained with this model between the observed and calculated radio bursts is very satisfactory. (auth)

10102 A SOFT X-RAY SURVEY OF THE SCUTUM-SERPENS-AQUILA REGION. Hill, R.W.; Burginyon, G.A.; Seward, F.D. (Lawrence Livermore Laboratory, University of California). Astrophys. J. 200: No. 3, 709-714 (15 Sept 1975).

Data from a 1973 June 23 rocket flight are presented and discussed. Soft X-ray spectra of the sources GX 17+2 and Ser X-1 together with the best-fit model spectra are given. We derive a location of Ser X-1 which confirms that listed in the 3U catalog. Upper limits are set to the X-ray flux from eight supernova remnants, and upper limits to their X-ray luminosity are calculated. Spatial structure in the diffuse soft X-ray background was observed. A map of the diffuse background in this region is derived. (auth)

10103 THE TRANSFER OF RADIO RECOMBINATION LINE RADIATION THROUGH A COLD GAS. I. HYDROGEN AND HELIUM LINES IN COMPACT H II REGIONS. Brown, R.L. (National Radio Astronomy Observatory, Green Bank, West Virginia); Gómez-González, J. Astrophys. J. 200: No. 3, 598-608 (15 Sept 1975).

We have considered the transfer of recombination line radiation that is produced in a high emission measure H II region (10^7 cm^{-6} pc) and passed through a cold, partially ionized gas. We conclude first that the cold gas will influence the observed recombination line spectrum at frequencies where the absolute value of the line optical depth in the cold gas is comparable with the ratio of the intensity in the line to the intensity in the continuum as emitted in the H II region. When this condition is satisfied, the observed lines will have nearly Gaussian profiles with widths comparable with the Doppler turbulence in the cold gas; this result obtains in spite of the fact that the lines emitted in the H —— region may be enormously broad and non-Gaussian owing to the effects of collisional broadening. We find secondly that the ratio of the peak antenna temperature of the helium α-line T (He) to the peak antenna temperature of the hyrogen α-line T (H) will be a function of principal quantum number. At high n where effects of the cold gas are likely to be most important we expect T (He)/T (H) to be proportional to the ratio of ionized species N (He$^+$)/N (H$^+$) *in the cold layer*; this ratio may be very low (<0.01) in such a medium and hence the inferred helium to hydrogen ratio in the H II region may appear anomalously low at low frequencies. Thirdly, since the He and H recombination lines are enhanced in different degrees in the cold gas, the ratio of line widths $\Delta\nu$ (He)/$\Delta\nu$ (H) will also be a function of n when n is large. Finally, the line-to-continuum ratio (T_L/T_c) $\Delta\nu\ \nu^{-2}$ depends on the parameters of the cold gas in a well defined way. The observational constraints and predictions of the model are discussed; applications to particular sources are deferred to a subsequent paper. (auth)

10104 THE 8–13 μ SPECTRA OF COMPACT H II REGIONS. Gillett, F.C. (Kitt Peak National Observatory); Forrest, W.J.; Merrill, K.M.; Capps, R.W.; Soifer, B.T. Astrophys. J. 200: No. 3, 609-620 (15 Sept 1975).

Observations of the 8–13 μ spectra of four compact H II regions [K3-50, W51-IRS1, W51-IRS 2, and W49-OH(2)] are reported. All of the spectra show a broad absorption feature centered around 9.7 μ. In addition, a 12.8 μ emission line, attributed to the Ne$^+$ fine-structure transition, has been found in W51-IRS 1 and probably in W49-OH(2), and is marginally present in K3-50 and W51-IRS 2. The broad absorption feature is consistent with absorption due to cold material, similar to that seen in emission in the Trapezium and probably predominantly "silicate" grains, lying between the emitting region and the Earth. Limits on the amount of absorption are established by considering two models of the underlying source emission spectrum, blackbody emission and Trapezium-like emission. It is found that the models with Trapezium emission spectra produce consistently better fits to the data. The visual extinction A_v (inferred from deficiencies in emission at $\lambda < 5\mu$) is compared with the optical depth at 9.7 μ, and it is found that $A_v/\tau_{9.7\mu} \gtrsim 10$–15. The weakness of the 12.8 μ Ne$^+$ emission in these sources is attributed to substantial absorption optical depth at 12.8 μ, and to Ne^{++} being the dominant ionic species. The derived 9.7 μ optical depths are combined with knowledge of the size of the molecular clouds to derive cloud masses that are consistent with molecular determinations. It is found that the emitting regions have larger gas/dust mass ratios than interstellar values by a factor of 20–200. (auth)

10105 PHYSICAL CONDITIONS AND THE LOCATIONS OF THE ABSORPTION-LINE SYSTEMS IN THE QSO 3C 286 AND THE BL LACERTAE OBJECT PKS 0735+178. Wolfe, A.M. (Department of Physics, University of Pittsburgh); Burbidge, G.R. Astrophys. J. 200: No. 3, 548-557 (15 Sept 1975).

The redshifted 21-cm and Mg II absorption lines observed in the QSO 3C 286 and the BL Lacertae object 0735+178, respectively, are analyzed to determine the location of the absorbing gas. We first describe evidence which supports the presence of neutral hydrogen intrinsic to QSOs, and then examine excitation conditions influencing the formation of 21-cm absorption lines. Due to the high spin temperature T_s resulting from the bright 21-cm continuum, the 21-cm absorption line observed in 3C 286 can arise close to the QSO only if Lα radiation determines the excitation of the hyperfine levels. The 21-cm line could also form in an intervening galaxy. The absence of redshifted Mg II absorption in the spectrum of 3C 286 places an upper limit of $3 \times 10^{-3}/T_s$ on the Mg$^+$/H I ratio in the column of absorbing H$_\odot$. This is compatible with a solar abundance ratio of Mg/H; but if the observed upper limit to Mg II absorption were reduced by a factor 2, this would require Mg$^+$/H I $< 10^{-2}$ (Mg/H)$_\odot$. An analysis of the Mg II absorption lines seen in 0735+178 leads to two possibilities: (*a*) a large column density of Mg$^+$ ions and low velocity dispersion; or (*b*) a low column density and large velocity dispersion. Whereas (*b*) is kinematically inconsistent with an intervening galaxy, (*a*) is not. We propose that 21-cm absorption features be searched for in the 30-cm continuum of 0735+178. If no absorption is seen, and (*a*) applies, then the spin temperature must be much higher than that observed in absorbing clouds in our Galaxy, thus making an intervening galaxy implausible. (auth)

10106 OPTICAL BEHAVIOR OF 20 VIOLENTLY VARIABLE EXTRAGALACTIC RADIO SOURCES. McGimsey, B.Q.; Smith, A.G.; Scott, R.L.; Leacock, R.J.; Edwards, P.L. (Rosemary Hill Observatory, University of Florida, Gainesville, Florida 32611); Hackney, R.L.; Hackney, K.R. Astron. J. 80: No. 11, 895-922 (Nov 1975).

A 7-yr photometric study of nearly 200 extragalactic radio sources has confirmed 20 of these objects as violent optical variables. Light curves and photometric data are given for these 20 sources, which are placed in one of four categories according to the type of variability displayed. (auth)

10107 A CORRELATION TEST OF THE INTRINSIC INTERPRETATION OF QSO ABSORPTION REDSHIFTS. Opher, R. (Physics Department, Technion-Israel Institute of Technology, Haifa, Israel). Astrophys. J. 200: No. 2, 450-453 (1 Sept 1975).

The general intrinsic interpretation of QSO absorption redshifts (clouds expelled from the QSO core) predicts that the expulsion velocities of the clouds have a high probability of being clustered together. A correlation function, $\bar{C}$, is defined which depends on the probability of three or more expulsion velocities of a QSO being clustered. The data of pairs of QSOs of similar z_{em} are used. Of prime importance, $\bar{C}$ is insensitive to cosmological models. If the absorption systems are intrinsic and correlated, $\bar{C}$ should be positive with a maximum value $\bar{C}=+100$ percent; if there is no physical connection between the absorption systems, then $\bar{C}\simeq 0$; a strong anticorrelation, or a tendency for QSOs to emit one or two clouds at well separated characteristic velocities, results in $\bar{C}\simeq -100$ percent. Data from the QSOs Ton 1530, 1331+170, PKS 0237, PHL 957, and 4C 05.34 are used to evaluate $\bar{C}$. A large positive value for $\bar{C}$ is found. (auth)

10108 HIGH-RESOLUTION, MULTIFREQUENCY RADIO OBSERVATIONS OF M82. Kronberg, P.P. (David Dunlap Observatory and Scarborough College, University of Toronto); Wilkinson, P.N. Astrophys. J. 200: No. 2, 430-438 (1 Sept 1975).

A supersynthesis radio map of the 8085 MHz emission in M82 is presented. The radio structure is complex, and is dominated by a bright unresolved source which is unpolarized ($<0.7\%$), becomes optically thick at $\nu\simeq 650$ MHz, and emits 65 percent of its 1666 MHz flux from within a region <1.2 pc in diameter. Nine other discrete radio components near the M82 nucleus have been isolated, and no other radio sources with surface brightness >5 K exist in the galaxy but outside the main radio source. An upper limit of 5 mJy can be set to any 8085 MHz radio emission from remnants, the brightest of which (source 41.9 + 58) is very recent ($\lesssim 150$ years) and has brightness and size limits which are consistent with the Σ-D relationship for known supernova remnants. The absence of a detectable linear polarization on all angular scales $\gtrsim 1''$ suggests that the magnetic field in the M82 nucleus is highly tangled on all size scales down to $\lesssim 20$ pc. (auth)

10109 PRECESSION IN TRANSIENT X-RAY SOURCES. Brecher, K. (Massachusetts Inst. of Tech., Cambridge). Nature (London); 257: No. 5523, 203(18 Sep 1975).

Reference is made to the x-ray sources Ariel 1118-61 and 0535 + 26. It is stated that the origin of the relatively long period and the transient nature of these sources is not clear. The pulse periods are about 405 and 104 sec. respectively, and decay occurs in a matter of days. The pulse rate of A1118-61 has been attributed to an extremely short binary star orbital period, or to an extremely long neutron star rotation period, but the quasi-sinusoidal nature of both x-ray light curves would seem difficult to account for by a rotation model. The 104 sec. period, on the other hand, seems very short for a binary orbital period. An earlier suggestion is here reconsidered, namely, that free precession may be important in such galactic x-ray sources (see also Nature 239 : 325 (1972)). Such precession could directly account for the shape of the light curves of transient x-ray sources. If the initial x-ray outburst is triggered by the close approach of a neutron star, or white dwarf, to its main sequence companion, either because the collapsed star is moving in a highly elliptical orbit, or because the radius of the companion is variable, the accompanying rapid mass transfer might well provide the torque necessary to excite free precession of large amplitude in the collapsed object. (UK)

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Refer also to abstracts 9989, 9990, 10035, 10195, 10214, 10221, and 10230.

10110 (NP-20591) PARTIAL ECLIPSE OF THE SUN ON NOVEMBER 3, 1975. Iannini, G. (Observatorio Astronomico, Cordoba (Argentina)). 1975. 16p. (In Spanish). Dep. NTIS (US Sales Only) $4.00.

10111 BEHAVIOR OF MINOR SPECIES IN THE SOLAR WIND. Ryan, J. M. (California Univ., Riverside (USA). Dept. of Physics); Axford, W. I. (Max-Planck-Institut fuer Aeronomie, Lindau/Harz (F.R. Germany)). J. Geophys.; 41: No. 3, 221-232(May 1975).

The flow of minor species in the solar wind is considered on the basis of a model in which all species are heated in an arbitrary manner as they leave the sun and the minor species interact with the background proton-electron plasma through the radial electric field associated with the latter and by means of Coulomb collisions. In order to produce satisfactory results in which the ions all move at more or less the same speed at the orbit of the earth, it is necessary to introduce heating functions such that each species is given energy in proportion to its mass. Coulomb collisions are found to be important as a means of removing energy from the heavier species close to the Sun and bringing all species closer to thermal equilibrium at great distances from the sun. Substantial velocity differences can occur between species, especially close to the Sun. Furthermore it is not difficult to construct solutions in which the bulk velocity of the helium ions exceeds that of the solar wind, as is often observed. (auth)

10112 SOME FEATURES OF SOLAR SPIKE BURST GENERATION. Zheleznyakov, V. V.; Zaitsev, V. V. (Nauchno-Issledovatel'skij Radiofizicheskij Inst., Gorkij (USSR)). Astron. Astrophys.; 39: No. 1, 107-111(Feb 1975).

The generation process of "spike" bursts is investigated. It is assumed that these bursts are caused by plasma waves excited in the process of the quasilinear relaxation of the electron stream in the solar corona. The time evolution of bursts and their association with Type III radio emission are considered. The possibility of rather short-lived ($3\times 10^{-3}-3\times 10^{-2}$s) bursts corresponding to the second harmonic of the plasma frequency is pointed out. We note that the induced scattering of plasma waves, accompanied by a decrease in the wave number, is essential to an explanation of the strong polarization that the bursts are observed to have. (auth)

10113 INFLUENCE OF THE SOLAR RADIATION PRESSURE ON THE MOTION OF PARTICLES IN THE SATURN RING. Polyakhova, E. N. Uch. Zap. Leningrad. Gos. Univ., Ser. Mat. Nauk; 31: No. 381, 192-217(1975). (In Russian)

The orbital evolution of the dust- and microparticles in the Saturn's rings under the influence of the direct solar radiation pressure and of the dynamical effect of the radiation is described. The investigation of the long-period orbital perturbations with account of Saturn's shadow gives the evaluation of the linear declinations of the particles from the equatorial plane and of maximal hypothetical thickness of the Saturn's rings about 20 km. It is shown that the secular action of the direct radiation pressure can increase the mean periodical eccentricity value to the hyperbolical one during the time of rings existence. This secular action in couple with the dynamical effect of the radiation accelerate the falling of the particles on the Saturn's surface. (auth)

10114 ACCELERATION OF HEAVY NUCLEI IN SOLAR FLARES. Sakurai, K. (National Aeronautics and Space Administration, Greenbelt, MD). Planet. Space Sci.; 23: No. 6, 955-959(Jun 1975).

The overabundance of heavy nuclei in solar cosmic rays of energy $\lesssim 10$ MeV/nucleon (sometimes up to ~ 30 MeV/nucleon) is explained by taking into account the pre-flare ionization states of these nuclei in the region where they are accelerated. A model is proposed which considers two-step accelerations associated with the initial development of solar flares. The first step is closely related to the triggering process of flares, while the second one starts with the development of the explosive phase. Further ionization of medium and heavy nuclei occurs through their interaction with keV electrons accelerated by the first-step acceleration. It is suggested that the role of these electrons is important in producing fully ionized atoms in the acceleration regions. (auth)

10115 ACCESS OF SOLAR ELECTRONS TO THE POLAR REGIONS. Nielsen, E.; Pomerantz, M. A. (Bartol Research Foundation, Swarthmore, PA). Planet. Space Sci.; 23: No. 6, 945-954(Jun 1975).

The interaction between the geomagnetic and interplanetary magnetic fields is studied through its effects upon the intensities of solar electrons reaching the polar caps during times of strongly anisotropic electron fluxes in the magnetosheath. During the particle event of November 18, 1968, electrons of solar origin were observed outside the magnetopause with detectors aboard OGO-5. Correlative studies of these satellite observations and concurrent measurements by riometers and ionospheric forward scatter systems in both polar regions have revealed that the initial stage of the associated polar cap absorption event is attributable to the prompt arrival of solar electrons. The electron flux precipitating into the south polar region was equal to or larger than the mean

directional flux in interplanetary space, whereas over the north pole it was equal to or less than the backscattered flux. This evidence of a north-south asymmetry in the solar electron flux at a time when the interplanetary magnetic field vector was nearly parallel with the ecliptic plane supports an open magnetospheric model. The ratio of particle intensities in the high polar latitude and low polar latitude regions in the southern hemisphere is consistent with that determined at times when the interplanetary electron fluxes were isotropic. The analysis indicates that an anisotropic electron flux may be isotropized at the magnetopause before propagating into the polar regions. (auth)

10116 HUNDRED YEARS OF CONTROVERSY OVER SUNSPOTS AND WEATHER. Meadows, A. J. (Univ. of Leicester, Eng.). Nature (London); 256: No. 5513, 95-97(10 Jul 1975).

After a century of accumulating correlation on the activity of sunspots and atmospheric phenomena around the Earth, there is still no clear idea as to what exactly the relationships are or what they mean. Much of present research was already under discussion in the nineteenth century. This paper is based on the author's recent Norman Lockyer Lecture at the University of Exeter. (auth)

10117 ANGULAR DISTRIBUTIONS OF SOLAR PROTONS AND ELECTRONS. Nielsen, E. (Bartol Research Foundation, Swarthmore, PA); Pomerantz, M. A.; West, H. I. Planet. Space Sci.; 23: No. 8, 1179-1194(Aug 1975).

High angular-resolution measurements of directional fluxes of solar particles in space have been obtained with detectors aboard OGO-5 during the cosmic ray event of November 18, 1968. This is the only case on record for which sharply-defined directional observations of protons and electrons covering a wide rigidity range (0.3 MV to 1.5 GV) are available. The satellite experiments provided data for determining pitch-angle distributions with respect to the direction of the local interplanetary magnetic field lines during the lengthy highly anisotropic phase of the event. A relationship for the variation of the unidirectional differential intensities of 3 to 25 MeV protons was determined. Soon after onset, 79 to 266 keV electrons arriving from the direction of the sun displayed an anisotropic component with the intensity varying as cos θ. Later, a double-peaked distribution appeared at the lower energies, whereas the flux at the upper end of the range covered by the experiment became isotropic. These results have been interpreted in the light of the temporal flux profiles and the state of the interplanetary medium. (auth)

10118 OBSERVATION OF THE TOTAL SOLAR ECLIPSE OF JULY 10, 1972, AT THE 4.0 sm WAVELENGTH. Method and Preliminary Results. Berlin, A. B.; Vitkovskii, V. V.; Gel-Freikh, G. B.; Enikeev, R. I.; Ipatov, A. V.; Nagnibeda, V. G.; Timofeeva, G. M. Uch. Zap. Leningrad. Gos. Univ., Ser. Mat. Nauk; 31: No. 381, 154-173(1975). (In Russian)

The total solar eclipse of July 10, 1972, was observed at the region of Anadyr (Chukotka) with the radiotelescope of Im diameter at the 4.0 cm wavelength. Preliminary results of the observations are presented. The method of observation and reducing of eclipse curves, as well as the sources of errors are discussed in details. Fine structure of local sources in polarized and unpolarized emission is obtained with the angular resolution of 5′′. The residual flux at the moment of the central phase was 8 per cent of the solar flux out of eclipse. (auth)

10119 INSTABILITY OF ALFVEN WAVES IN THE SOLAR WIND. Dobrowolny, M. (L'Aquila Univ., Italy). pp 388-389 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

10120 SOLAR WIND-VENUS INTERACTION OBSERVED FROM MAGNETIC FIELD EXPERIMENT ON MARINER 10. Whang, Y. C. (Catholic Univ. of America, Washington, DC); Ness, N. F.; Behannon, K. W.; Lepping, R. P. pp 428-432 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

10121 VARIATION OF THE SOLAR WIND FLUX WITH HELIOGRAPHIC LATITUDE, DEDUCED FROM ITS INTERACTION WITH INTERPLANETARY HYDROGEN. Blamont, J. (CNRS, Essonne, France). pp 321-328 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

10122 ENHANCEMENT OF SOLAR WIND FLUCTUATIONS WITH SCALE SIZE NEAR THE PROTON GYRORADIUS. Neugebauer, M. (California Inst. of Tech., Pasadena). pp 373-374 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third concerence on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

10123 SIMULATION OF COLLIDING SOLAR WIND STREAMS WITH MULTIFLUID CODES. Papadopoulos, K. (Univ. of Maryland, College Park); Clark, R. W.; Wagner, C. E. pp 343-350 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

10124 MODEL FOR THE PROPAGATION OF FLARE-ASSOCIATED INTERPLANETARY SHOCK WAVES. Chao, J. K. (Univ. of Arizona, Tucson). pp 169-174 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

10125 X-RAY OBSERVATIONS OF CORONAL HOLES AND THEIR RELATION TO HIGH VELOCITY SOLAR WIND STREAMS. Krieger, A. S. (American Science and Engineering, Inc., Cambridge, MA); Vaiana, G. S.; Timothy, A. F.; Lazarus, A. J.; Sullivan, J. D. pp 132-139 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

10126 SOLAR FIVE-MINUTE OSCILLATIONS AS A RESONANCE PHENOMENON. Chiuderi, C. (Osservatorio Astrofisico di Arcetri, Firenze, Italy); Giovanardi, C. Astrophys. J. Lett. 200: No. 3, L165-L166 (15 Sept 1975).

The response of a nonisothermal gravitational atmosphere to an oscillatory perturbation is studied in the case of a parabolic temperature profile. The exact analytical solution is then applied to a model solar atmosphere. An interpretation of the 5-minute oscillations as free oscillations of the atmosphere as a whole is proposed. (auth)

10127 BETATRON ACCELERATION IN A LARGE SOLAR HARD X—RAY BURST. Brown, J.C.; Hoyng, P. (Space Research Laboratory of the Astronomical Institute, Utrecht, The Netherlands). Astrophys. J. 200: No. 3, 734-746 (15 Sept 1975).

The problem of diagnosing flare particle acceleration mechanisms from hard X-ray bursts is discussed, and it is argued that the electron trap model of bursts is more amenable to observational investigation at present than models of thick-target type. It is then shown that data for the large X-ray burst of 1972 August 4 are consistent with the source electrons being trapped in a very large vibrating coronal magnetic bottle. Furthermore, the observations show that the burst time profile is not dominated by collisional losses. It is proposed instead that the entire profile is essentially determined by betatron action of the varying trap field on the electrons. This betatron model is then analyzed in detail and shown to predict very well the observed correlation of electron flux and spectral index in this event when it is supposed that the electrons are initially produced by runaway in a direct electric field. Comparison of the model with observations permits inference of the approximate form of magnetic field evolution in the trap. Finally the physics behind this field evolution is briefly considered. (auth)

10128 ON THE STATISTICAL DESCRIPTION OF INHOMOGENEITIES IN THE QUIET SOLAR ATMOSPHERE I. LINEAR REGRESSION ANALYSIS AND ABSOLUTE CALIBRATION OF MULTICHANNEL OBSERVATIONS OF THE Ca^+ EMISSION NETWORK. Skumanich, A.; Smythe, C. (High Altitude Observatory, National Center for Atmospheric Research, Boulder, Colorado); Frazier, E.N. Astrophys. J. 200: No. 3, 747-764 (15 Sept 1975).

Observations with a 2.4 square aperture (1968 epoch) of the Ca^+ K core brightness (1.1 Å bandwidth), vertical magnetic field, vertical velocity, and continuum brightness have been analyzed to yield average network and nonnetwork values and dispersions as well as linear regression relations. The statistics of all variables but the continuum consist of a symmetric core superposed on an extended tail which is associated with the chromospheric network. Network statistics were derived by subtraction of a Gaussian fit to the core which was taken to represent nonnetwork fluctuations. The velocity network was only partially resolved so that its distribution, and that of the continuum, was obtained by identifying network regions as those with field ≥ 10 gauss. The average network has a field of 26 gauss, independent of polarity, a Ca^+ brightness 1.27 that of the average nonnetwork or undisturbed chromosphere, a downdraft velocity of 41 m s^{-1}, a monochromatic continuum enhancement of 0.34 percent, and covers 39 percent of the quiet Sun. The network brightness increases relative to its average with a slope of 21.1 percent $gauss^{-1}$ for Ca^+ and 2.6 percent $gauss^{-1}$ for the continuum while the downdraft velocity increases by 1.6 m s^{-1} $gauss^{-1}$ for fields between 25 and 120 gauss. Nonlinear effects appear for larger and smaller fields. The average outward flux density

of network over nonnetwork regions is 2.4×10^5 ergs cm^{-2} s^{-1} for Ca$^+$ K and 3.8×10^8 ergs cm^{-2} s^{-1} for the continuum. Photometric calibration of the Ca$^+$ K line observations was effected by a comparison of the observed relative contrast statistics with a statistically equivalent absolute brightness distribution obtained from a calibrated slit spectrum of the Ca$^+$ K line. (auth)

10129 THE SOLAR SPECTRUM FROM 1173 TO 1324 Å. Chipman, E.; Bruner, E.C. Jr. (Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder). Astrophys. J. 200: No. 3, 765-772 (15 Sept 1975).

We present some of the results of a rocket flight which obtained a high-resolution stigmatic spectrum of the Sun in the region 1173–1324 Å. A list of 179 lines observed in this region is presented, with intensities, widths, and approximate excitation classes for each line. A reproduction and finding chart of the spectrum is included, along with discussion of some individual lines of special interest. (auth)

10130 LOW-ENERGY NUCLEOSYNTHESIS OF LITHIUM, BERYLLIUM, AND BORON. Canal, R.; Isern, J.; Sanahuja, B. (Departamento de Física de la Tierra y del Cosmos, Universidad de Barcelona, Spain). Astrophys. J. 200: No. 3, 646-652 (15 Sept 1975).

The results from detailed calculations of lithium, beryllium, and boron production by spallation reactions at low energies are reported. Proton and α-induced reactions, destruction, and deceleration effects are included. The abundances and isotopic ratios, for particle spectra analogous to those observed in solar flares (power law in kinetic energy), agree with the solar system values. We therefore suggest stellar flares and/or low-energy cosmic rays as the main contributors to the nucleosynthesis of these elements. (auth)

10131 EMISSION-LINE PROFILES IN SOLAR FLARES. Grachev, S.I. (Leningrad University). Sov. Astron.—AJ 19: No. 2, 200-202 (Sept 1975).

Emission-line profiles for a source function $S(\tau) = a(1+B\tau)$ are calculated for radiation emerging from a one-dimensional medium of optical thickness τ_0 moving with a constant velocity gradient γ. The parameters γ, $\gamma\tau_0$, B, a, and $\Delta\nu_D$ can be evaluated by comparing computed and observed profiles. The distribution of primary sources can then be established by substituting these parameters into the integral equation of radiative transfer. Such a comparison is made with a profile observed in a solar-flare spectrum. (auth)

10132 METAL-LINE EMISSION IN A BRIGHT DECAYING PROMINENCE. Yakovkin, N.A.; Zel'dina, M.Yu.; Rakhubovskii, A.S. (Kiev University Observatory). Sov. Astron.—AJ 19: No. 2, 203-206 (Sept 1975).

The abundance of Na, Mg, Ca, Sc, Ti, Fe, Sr, and Ba in a prominence relative to hydrogen is determined and (except for Na) found to be approximately the same as in the photosphere and chromosphere. The metals are singly ionized, except that $[Ca^{++}]\simeq[Ca^+]$, $[Sr^{++}]=0.5[Sr^+]$, and $[Ba^{++}]=6[Ba^+]$; Lyman-α radiation emitted in the prominence is responsible for the secondary ionization of these elements from metastable states. This Lα radiation also ionizes neutral iron. Solar near-ultraviolet radiation produces the single ionization of the other metals. The metal-line emission results from scattering of photospheric radiation; only the Ca$^+$, H and K lines are excited by electron collisions. (auth)

10133 PULSATIONS OF THE CONTINUUM SOLAR RADIO EMISSION AT METER WAVELENGTHS. Markeev, A.K.; Fomichev, V.V.; Chertok, I.M. (Institute of Terrestrial Magnetism, the Ionosphere, and the Propagation of Radio Waves, Academy of Sciences of the USSR). Sov. Astron.—AJ 19: No. 2, 207-211 (Sept 1975).

A phenomenon observed on May 21, 1973 at the Institute of Terrestrial Magnetism, the Ionosphere, and the Propagation of Radio Waves, by means of spectrographs (45–90 and 140–180 MHz) and polarimeters (74 and 204 MHz), is analyzed. Against the background of a continuum storm, pulsations of the radio emission with characteristic duration 10–20 sec were observed for several hours. The pulsations exhibited a drift from low to high frequencies at 12–25 MHz/sec. The relative amplitude of the pulsations was more than 300% at 74 MHz and decreased monotonically with increasing frequency to 90% at 204 MHz. The circular polarization of the background of the continuum storm, corresponding to an ordinary wave, was 65–75%. The increase in the flux density at 74 MHz was accompanied by a decrease in the degree of polarization to 50%, while the weakening of the continuum was accompanied by and increase in the degree of polarization right up to 100%. The main features of the phenomenon are explained in the framework of a model in which the pulsations are attributed to the radic emission of electron streams ejected quasiperiodically from the neutral current sheet of the coronal helmet magnetic structure and propagating toward the solar surface at (5–10) $\cdot10^9$ cm/sec. (auth)

10134 INFLUENCE OF PRESSURE ANISOTROPY OF THE NEAR-SOLAR PLASMA ON THE PROPAGATION OF ALFVÉN WAVES. Sobolev, S.V. (Institute of Cosmic Research, Academy of Sciences of the USSR). Sov. Astron.—AJ 19: No. 2, 212-214 (Sept 1975).

A study is made of the propagation of Alfvén waves in an inhomogeneous anisotropic plasma. Expressions are obtained for the coefficients of reflection and transmission of an Alfvén wave at a contact discontinuity and also the dependence of the laws of reflection and refraction on the degree of anisotropy of the plasma pressure. It is shown that anisotropy of the pressure has a strong influence on the variation in the amplitude of the Alfvén wave in a weakly inhomogeneous medium if the gas-kinetic pressure is of the order or greater than the pressure of the magnetic field (solar wind). A study is made of the propagation of an Alfvén wave in an isothermal atmosphere with homogeneous gravitational field. It is shown for the example of the lower chromosphere of the Sun that the amplitude of the wave propagating upward decreases more rapidly the greater the difference between the pressure of the plasma along and at right angles to the magnetic field. (auth)

10135 POSSIBLE MECHANISM OF THE SOLAR CYCLE. Vandakurov, Yu.V. (A. F. Ioffe Physicotechnical Institute, Academy of Sciences of the USSR). Sov. Astron.—AJ 19: No. 2, 215-219 (Sept 1975).

It is conjectured that a magnetic field in the convective envelopes of stars compensates a mean azimuthal force, which is equivalent to negative viscosity, produced by the convective motions. Some examples confirm the existence of such a negative viscosity effect. According to the conjecture, the azimuthal force not only maintains the differential rotation of the medium but also draws out the lines of force of the field, producing a toroidal from a poloidal field. It is assumed that the direction of the poloidal field component reverses at the end of the enhancement stage in a certain layer situated below the main zone of the enhancement of the field. The reversal of the field direction is attributed to an instability (however, this process needs further study). (auth)

10136 ORIGIN OF IRREGULARITIES IN FAST STREAMS OF THE SOLAR WIND. Lotova, N.A. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR). Sov. Astron.—AJ 19: No. 2, 220-222 (Sept 1975).

A study is made of the small-scale irregularities in the gast streams that are associated with the sector structure of the interplanetary medium and are responsible for enhancing the scintillation of radio sources. The characteristics of streams of this kind suggest that their irregularities may be due to a magnetoacoustic or anisotropic temperature instability of the plasma. (auth)

10137 ABSOLUTE *f*-VALUES FOR RESONANCE LINES OF NEUTRAL TITANIUM. Bell, G.D.; Kalman, L.B.; Tubbs, E.F. (Department of Physics, Harvey Mudd College, Claremont, California). Astrophys. J. 200: No. 2, 520-523 (1 Sept 1975).

Absolute *f*-values for 13 resonance lines of Ti I have been experimentally measured by the atomic-beam method. Difficulties in evaporation of titanium were overcome by using a TiC boat, and gettering effects were determined by comparing microbalance weighings of instantaneous deposit rates with quantitative chemical analyses of total deposits. Comparisons are made with other experimental results, and conversion factors are given for placing previously published relative *f*-values on an absolute scale. Also, the effect of an improved absolute scale for Ti I *gf*-values on the abundance of titanium in the solar photosphere is discussed. (auth)

10138 THE INTRINSIC VISUAL OBLATENESS OF THE SUN. Hill, H.A. (Department of Physics, University of Arizona); Stebbins, R.T. Astrophys. J. 200: No. 2, 471-483 (1 Sept 1975).

New solar oblateness observations are reported that yield a value of 18.4 ± 12.5 milli-arcsec for the difference between equatorial and polar diameters. These observations were conducted when the time-varying, excess equatorial brightness was markedly reduced, greatly simplifying the interpretation of the apparent solar oblateness. The experimental scheme for defining the "edge" of the Sun and monitoring the shape of the extreme limb darkening function is summarized along with the description of the instrumentation. Sources of systematic error are exhaustively surveyed in order to extract the intrinsic visual oblateness of the Sun. The result further strengthens the conclusion of Hill *et al.* that the grave consequence of the Dicke-Goldenberg work for Einstein's general theory of relativity is removed. The new result excludes an oblateness as large as that required by the rapidly rotating interior models used to explain the low neutrino flux. (auth)

10139 THE FINITE FOURIER TRANSFORM DEFINITION OF AN EDGE ON THE SOLAR DISK. Hill, H.A. (Department of Physics, University of Arizona); Stebbins, R.T.; Oleson, J.R. Astrophys. J. 200: No. 2, 484-498 (1 Sept 1975).

A new technique for locating the edge of the Sun is proposed. The technique uses a finite Fourier transform of the observed limb darkening function to achieve reduced sensitivity to atmospheric and instrumental effects and heightened sensitivity to the shape of the intrinsic limb darkening function. A theory is developed that predicts these sensitivities. In order to facilitate wider application, general relations are calculated. A testing program which complements the theory is also

reported. The location of the edge is shown to be influenced only by solar phenomena down to the milli-arcsecond range. (auth)

10140 WAVES IN THE SOLAR ATMOSPHERE. IV. MAGNETO-GRAVITY AND ACOUSTIC-GRAVITY MODES. Schwartz, R.A. (New York University); Stein, R.F. Astrophys. J. 200: No. 2, 499-502 (1 Sept 1975).

We consider the properties of waves in a stratified, conducting atmosphere under the influence of an applied magnetic field. Wave normal surfaces are exhibited for acoustic-gravity and magneto-gravity waves, and the propagation of these modes is compared. (auth)

10141 INTERPLANETARY PARTICLE FLUXES OBSERVED BY OV5-6 SATELLITE. Yates, G. K. (Cambridge Research Labs., Bedford, MA); Katz, L.; Sellers, B.; Hanser, F. A. pp 597-602 of Correlated Interplanetary and Magnetospheric Observations. Page, D. E. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From seventh ESLAB conference on correlated interplanetary and magnetospheric observations; Saulgau, Ger. (22 May 1973).

The OV5-6 (1969-046B) satellite launched May 23, 1969, and with 2.9 earth perigee, 19.3 radii apogee and 30.6 deg inclination, has observed numerous solar events since its launch. The proton-alpha telescope aboard this satellite is capable of measuring protons in eight energy bins between 1 and 100 MeV and alphas in three energy bins between 20 and 100 MeV. Time histories of fluxes of various channels and energy spectra are presented for the August 2-15, 1972, series of events. This multiple event included a more than 10,000-fold increase in the proton and alpha-particle fluxes. (auth)

10142 RELATION OF CORONAL MAGNETIC STRUCTURE TO THE INTERPLANETARY PROTON EVENTS OF AUGUST 2-9, 1972. Roelof, E. C. (Univ. of New Hampshire, Durham); Lezniak, J. A.; Webber, W. R.; McDonald, F. B.; Teegarden, B. J.; Trainor, J. H. pp 563-571 of Correlated Interplanetary and Magnetospheric Observations. Page, D. E. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From seventh ESLAB conference on correlated interplanetary and magnetospheric observations; Saulgau, Ger. (22 May 1973).

In order to interpret the time history of protons of energy greater than about 13.5 MeV observed on Pioneers 9 and 10 and IMP 5 from the flares of Aug. 2, 4 and 7, the coronal connection longitudes of the interplanetary field lines were estimated using the solar wind velocities measured on the spacecraft. There is reasonable agreement between the observed magnetic field polarity at Pioneer 9 and the equatorial chromospheric polarity at the inferred connection longitudes. The protons appear to be released preferentially in a large magnetic neutral-line complex that surrounds the flare region (McMath 11976) from Carrington longitudes 0 to 60. Although impulsive proton events were observed from all three flares by Pioneer 9, only the second two were seen at earth, and Pioneer 10 never showed comparable impulsive response. These apparent discrepancies are resolved by comparison with magnetic neutral line structure. (auth)

10143 SOLAR PARTICLE OBSERVATIONS DURING THE AUGUST 1972 EVENT. Lanzerotti, L. J.; Maclennan, C. G. (Bell Telephone Labs., Inc., Murray Hill, NJ). pp 587-596 of Correlated Interplanetary and Magnetospheric Observations. Page, D. E. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From 7th ESLAB conference on correlated interplanetary and magnetospheric observations; Saulgau, Ger, (22 May 1973).

Observations of solar electron, proton, and α particles made with the Explorer-41 satellite at 1 AU during the period of intense solar activity in August 1972 are presented. The intensities of low energy particles are the largest measured at the earth during the 20th solar cycle; the peak fluxes of 500 keV protons are more than a factor of 10 times the intensity of those measured during the event of Apr. 10, 1969. Some comments are also made on the intensities of interplanetary particles measured at 1 AU during a two-week period prior to the August intervals as well as on the intensities of the ground-level events during the August period. (auth)

10144 MeV ELECTRONS, PROTONS, AND α PARTICLES OBSERVED AUGUST 2-12, 1972. Page, D. E.; Domingo, V.; Wenzel, K. P. (ESRO, Noordwijk, Netherlands). pp 573-585 of Correlated Interplanetary and Magnetospheric Observations. Page, D. E. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From 7th ESLAB conference on correlated interplanetary and magnetospheric observations; Saulgau, Ger. (22 May 1973).

An experiment was conducted on the ESRO satellite HEOS2 to monitor electrons, protons, and α particles during specific solar particle events. Time constants of the decay and the anistropies observed for different particle species were studied. Information was obtained concerning the interplanetary conditions. The conclusions derived from early particle data were in good agreement with more recent directly measured interplanetary data. (IAA)

10145 SOLAR PROMINENCES. Tandberg-Hanssen, E. Geophysics and Astrophysics Monographs. Vol. 12. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974). 169p. $20.16.

The historical background of the study of solar prominences is considered along with morphological classifications, observational data, models, and questions regarding the formation of prominences. The stability of prominences is investigated, taking into account the heating problem, the importance of magnetic fields, and the disparition brusque as an instability. Questions concerning the interaction of prominences with centers of activity are also explored, giving attention to the influence of sunspots, prominence flare interactions, and the interaction of prominences with each other. (IAA)

10146 POSSIBILITY OF DETECTING SOLAR FLARE EFFECTS IN THE ZODIACAL LIGHT. Misconi, N. Y.; Hanner, M. S. (State Univ. of New York, Albany). Planet. Space Sci.; 23: No. 9, 1329-1335(Sep 1975).

To evaluate possible effects of solar flares on the brightness of the inner zodiacal light, it is necessary to consider the brightness contribution along the line of sight and as a function of Sun-particle distance. For this purpose, models of the brightness contribution along the line of sight are presented for both dielectric and metallic particles with a spatial distribution of the form $r^{-\nu}$, $\nu = 0, 1, 2$. These models are discussed in terms of the geometry of shock front interaction. A reported zodiacal light enhancement following a solar flare (Blackwell and Ingham (Mon. Not. R, Astr. Soc.; 122: 143 (1961)) is analyzed on the basis of the shock front geometry. (auth)

10147 SIMULTANEOUS OBSERVATIONS OF PROTON AND α FLUXES DURING THE PERIOD 29 OCTOBER-3 NOVEMBER 1972. Katz, L. (Cambridge Research Labs., Bedford, MA); Rothwell, P. L.; Yates, G. K; Sellers, B.; Hanser, F. A. pp 479-483 of Correlated Interplanetary and Magnetospheric Observations. Page, D. E. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From 7th ESLAB conference on correlated interplanetary and magnetospheric observations; Saulgau, Ger. (22 May 1973).

Solar protons and α particles were simultaneously measured on the OV5-6 (1969-046B) and S72-1 (1972-076B) satellite during the October-November 1972 event. The OV5-6 satellite (apogee 113,000 km) was predominantly outside the magnetosphere, while the S72-1 satellite was in a polar, circular orbit with an altitude of 750 km. The proton flux time-history, proton energy spectra, and the α to proton ratios measured on both satellites are in agreement. The α to proton ratio at 6.8 MeV per nucleon varies with time from 0.1% to 1.5% and back to 0.4%. The α/proton ratio increases with energy from 0.4% at 5.1 MeV per nucleon to 1.2% at 9.8 MeV per nucleon. (auth)

10148 VALUE OF MULTI-SPACECRAFT MEASUREMENTS. Shea, M. A.; Smart, D. F. (Cambridge Research Labs., Bedford, MA). pp 381-396 of Correlated Interplanetary and Magnetospheric Observations. Page, D. E. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From 7th ESLAB conference on correlated interplanetary and magnetospheric observations; Saulgau, Ger. (22 May 1973).

The utilization of multi-spacecraft and multi-detector measurements has long been recognized as a valuable tool in unraveling the intricacies and complexities of solar particle propagation through the interplanetary medium and in the magnetosphere. To provide as complete a solar particle picture as possible for various analyses, a catalog of solar particle events during the first part of the 20th solar cycle is being prepared. This requires examining the data from detectors on various satellites and space probes and identifying the onset times for various solar particle energies and the times of maximum intensities and the fluxes. Examples of problems encountered in this type of compilation, some of which can be resolved by multi-spacecraft detection are cited. (auth)

10149 OBSERVATIONS OF SOLAR PARTICLE PROPAGATION. Lanzerotti, L. J. (Bell Telephone Labs., Inc., Murray Hill, NJ). pp 345-379 of Correlated Interplanetary and Magnetospheric Observations. Page, D. E. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From 7th ESLAB conference on correlated interplanetary and magnetospheric observations; Saulgau, Ger. (22 May 1973).

A review is given of the observations of the propagation characteristics of solar particles from impulsive flare events that principally have been reported since the Third ESLAB Symposium in 1969. The review is limited to current interpreta-

tions of the observations in terms of the complete particle transport equation and the recent attempts at reconciling values of the elements of the diffusion tensor as obtained from particle observations and from measurements of interplanetary magnetic field fluctuations. The importance of understanding and modeling the effects of flare-produced shock waves on the diffusive-convective low energy particle time-intensity profiles is stressed. The present observational data on particle modulations by shock waves is reviewed. (auth)

10150 TIME PROFILES AND PHOTON SPECTRA OF SOLAR HARD X-RAYS. Van Beek, H. F.; De Feiter, L. D.; De Jager, C. (Rijksuniversitet, Utrecht). pp 533-543 of Correlated Interplanetary and Magnetospheric Observations. Page, D. E. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From 7th ESLAB conference on correlated interplanetary and magnetospheric observations; Saulgau, Ger. (22 May 1973).

With a spectrometer aboard the ESRO TD-1A satellite, time profiles and photon spectra of solar x-rays have been observed in the energy range above 24 keV. Most of the x-ray bursts studied thus far appear to consist of numerous short-lived spikes with rise and decay times of a few seconds. Such spikes, called "Elementary Flare Bursts" (EFB's) cluster together in large numbers and constitute the conventional high energy flare. The form of the photon spectra could be determined very accurately and was in all cases of the power-law type. For the Aug. 4, 1972 flare, the photon spectra appear to be combinations of two power-law spectra; for the lower energies the spectral coefficient is smaller than for the higher energies. The transition energy is about 60 keV. (auth)

10151 γ RAY OBSERVATIONS DURING THE AUGUST 1972 SOLAR ACTIVITY. Chupp, E. L.; Forrest, D. J.; Suri, A. N. (Univ. of New Hampshire, Durham). pp 519-531 of Correlated Interplanetary and Magnetospheric Observations. Page, D. E. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From 7th ESLAB conference on correlated interplanetary and magnetospheric observations; Saulgau, Ger. (22 May 1973).

During the solar activity period in August 1972, the UNH γ ray monitor on the OSO-7 satellite measured γ ray line and continuum fluxes of solar origin on at least two occasions; August 4 and 7. In this discussion, the experiment and the γ ray line observations are reviewed with a few brief remarks on interpretation. The specific observations discussed are measurements of γ ray lines at 0.51 and 2.2 MeV during two of the largest optical solar flares. Evidence for lines at other energies is also given. (auth)

Galaxies

Refer also to abstracts 9996, 10001, 10009, 10033, 10067, 10078, 10098, 10099, and 10101.

10152 OBSERVATIONS OF 6 GHz ABSORPTION LINES FROM THE $^2\pi_{\frac{1}{2}}$, J = $\frac{1}{2}$ STATE OF OH. Gardner, F. F.; Whiteoak, J. B. (Commonwealth Scientific and Industrial Research Organization, Epping, Australia). Mon. Not. R. Astron. Soc.; 172: No. 2, 9P-13P(Aug 1975).

Absorption has been detected at the 6035 MHz (F = 3-3) and 6031 MHz (F = 2-2) lines of the $^2\pi_{\frac{1}{2}}$, J = $\frac{1}{2}$ state of OH in the direction of a number of H II regions, usually of high brightness. The velocities and widths correspond approximately with those found for the ground-state lines of OH, and for absorption at the 3335 MHz (F = 1-1) line of CH. Excitation of the higher state of OH corresponds to a temperature in the range 40-100K, and is probably caused by radiation from the infrared sources associated with the H II regions rather than by collisions. (auth)

10153 INFRARED PHOTOMETRY OF NGC 1068 AT 25 AND 33μ. Simon, T.; Dyck, H. M. (Univ. of Hawaii, Honolulu). Mon. Not. R. Astron. Soc.; 172: No. 2, 19P-21P(Aug 1975).

Ground-based broadband photometry centered at wavelengths of 25μ and 33μ confirms a previously-reported turnover in the infrared spectrum of the Seyfert galaxy NGC 1068. (auth)

10154 SCALE OF GALAXY CLUSTERING AND THE MEAN MATTER DENSITY OF THE UNIVERSE. Fall, S. M. (Cambridge Univ., Eng.). Mon. Not. R. Astron. Soc.; 172: No. 2, 23P-26P(Aug 1975).

The correlation energy computed from Peebles' power-law galaxy covariance function suggests that, if the gravitational instability picture is correct, then there must be a feature in the covariance function where it steepens. The scale of this cut-off cannot be accurately determined by this argument but a comparison of the random kinetic energies of galaxies with their correlation energy gives an estimate of the mean matter density of the Universe. The suggested value is less than 5 per cent of the closure density if most matter is distributed as galaxies are. (auth)

10155 ULTRAVIOLET FLUXES FROM SOME NEARBY GALAXIES. Carnochan, D. J.; Navach, C.; Wilson, R. (University Coll., London). Mon. Not. R. Astron. Soc.; 172: No. 2, 27P-28P(Aug 1975).

Ultraviolet fluxes in four wavebands are presented for some bright galaxies as observed with the sky-survey telescope (S2-68) in the ESRO TD-1 satellite. The data do not show the pronounced increase in the far ultraviolet that is a characteristic of the observations of similar galaxies made with OAO-2. (auth)

10156 LARGE SCALE LINE SPLITTING ASSOCIATED WITH THE DENSE NEUTRAL INTRUSIONS AND IONIZATION FRONTS IN THE CORE OF M8. Elliott, K. H.; Meaburn, J. (Univ. of Manchester, Eng.). Mon. Not. R. Astron. Soc.; 172: No. 2, 427-431(Aug 1975).

A large area where the [O III] line is distinctly split was discovered and mapped in the very core of M8. This was carried out with a Fabry–Perot monochromator. These motions appear to be related to the ionization fronts which are moving into the obvious neutral volumes in this nebula. A model is presented which seeks to explain many of the observed phenomena of this complex of H II, H I, dust molecules and stars. (auth)

10157 40-350 MICRON EMISSION FROM NGC 2023. Emerson, J. P.; Furniss, I.; Jennings, R. E. (University Coll., London). Mon. Not. R. Astron. Soc.; 172: No. 2, 411-420(Aug 1975).

40-350 μm photometric measurement of the reflection nebula and molecular cloud NGC 2023 is reported. Absorption by dust of ultraviolet photons from the B star which illuminates the reflection nebula is capable of powering the far infrared emission. Comparison of this source with OMC2 and the KL nebula suggests that the dust temperature is roughly proportional to the gas temperature (=CO brightness temperature) for ice, silicate or graphite grains. If the dust and gas temperatures are equal and the grains are made of ice the gas to dust ratios in all three objects are close to the value in the interstellar medium. (auth)

10158 COOLING OF THE 6-CENTIMETER AND 2-CENTIMETER DOUBLETS OF INTERSTELLAR H_2CO BY COLLISION: AN ACCURATE QUANTUM-MECHANICAL CALCULATION. Garrison, B.J. (Department of Chemistry and Inorganic Materials Research Division, Lawrence Berkeley Laboratory, University of California, Berkeley); Lester, W.A., Jr.; Miller, W.H.; Green, S. Astrophys. J. Lett. 200: No. 3, L175-L177 (15 Sept 1975).

Cooling of the 6-cm and 2-cm levels of interstellar H_2CO by a collisional pump is verified by a series of accurate quantum-mechanical calculations. The j=3 ortho doublet is found to be an integral part of the collisional pumping scheme. (auth)

10159 PLANETARY NEBULAE NEAR THE GALACTIC CENTER. Vorontsov-Vel'yaminov, B.A.; Kostyakova, E.B.; Dokuchaeva, O.D.; Arkhipova, V.P. (Shternberg Astronomical Institute, Moscow). Sov. Astron.—AJ 19: No. 2, 163-168 (Sept 1975).

Absolute spectrophotometry of planetary nebulae belonging to the large group in the galactic-center direction is reported. The spectrograms (160 A/mm dispersion at H γ) were obtained by the Abastumani Astrophysical Observatory staff with an 8° objective prism on the 70 cm meniscus telescope. The monochromatic energy-flux density (in units of 1 erg·cm^{-2}·sec^{-1}) has been measured in a number of emission lines for 47 presumed planetaries. The results of a detailed spectrum analysis are given for 20 of the most interesting objects. Three new planetaries have been discovered. The mean intensity ratio of the [O III] N_1 line relative to the Hβ line has been estimated for nebulae in the central group and in the general field; the values are 6.0 and 9.5, respectively. This substantial difference supports the authors' previous suggestion that planetaries in the central group are physically distinct from those in the general field, tending to be objects of lower excitation. (auth)

10160 PHOTOELECTRIC OBSERVATIONS OF COMPACT GALAXIES NEAR M31. Sharov, A.S.; Lyutyi, V.M.; Esipov, V.F. (Shternberg Astronomical Institute, Moscow). Sov. Astron.—AJ 19: No. 2, 174-176 (Sept 1975).

Several compact galaxies in the Andromeda Nebula (M31) have been observed photoelectrically with the 2.6 m Shain reflector of the Crimean Astrophysical Observatory. A systematic difference is found between the photoelectric and photographic V magnitudes of the galaxies, leading to an overestimate of the photographic B–V color index. The photoelectric measurements indicate that some of the compact galaxies are red objects with B–V $\simeq 1^m.2$-$1^m.3$. The observed B–V and U–B colors may be attributable to a distinctive star population in these galaxies. (auth)

10161 GALACTIC ABSORPTION DERIVED FROM THE APPARENT DISTRIBUTION OF GALAXIES. Fesenko, B.I. (Pskov Teachers' College). Sov. Astron.—AJ 19: No. 2, 177-181 (Sept 1975).

The fluctuations in the apparent distribution of galaxies are investigated on the basis of the Lick Observatory counts. A model developed in a previous paper serves to eliminate the effect of galaxy clustering. Variability in the observing conditions is taken into account

statistically. The fluctuations in the absorption are found to satisfy the cosecant law. No evidence of intergalactic absorption irregularities or of second-order clustering is detected. The following parameters are determined for interstellar clouds: $<\epsilon>\nu_0=0.563\pm0.043$, $<\epsilon^2>\nu_0=0.1002\pm0.0087$, and $<\epsilon^3>\nu_0=0.0204\pm0.0091$, where ϵ denotes the absorption in an individual cloud and ν_0 is the mean number of clouds in the direction toward the galactic pole. An approximate law is derived for the distribution of absorption in various directions. Two cases are considered: A) an arbitrary direction; B) a direction selected near a visible galaxy. The mean galactic absorption is $0^m.10$–$0^m.16$ smaller in case B than in case A. Regions close to the galactic plane are excluded. In the direction toward the galactic pole the mean absorption is $0^m.486\pm0^m.04$. (auth)

10162 DETECTION OF INTERSTELLAR NITROGEN SULFIDE. Gottlieb, C.A.; Ball, J.A.; Gottlieb, E.W.; Lada, C.J.; Penfield, H. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory). Astrophys. J. Lett. 200: No. 3, L147-L149 (15 Sept 1975).

We report the detection and positive identification of interstellar NS. We observed emission toward Sgr B2 from the $J=5/2\rightarrow3/2$ $^2\Pi_{1/2}$ *c*-state (115.16 GHz) and *d*-state (115.6 GHz) transitions of $^{14}N^{32}S$. The NS column density is $\sim10^{14}$ cm^{-2} derived from statistical equilibrium calculations. We have compared the NS results with other sulfur-containing molecules. (auth)

10163 DETECTION OF 2.6-MILLIMETER RADIATION PROBABLY DUE TO NITROGEN SULFIDE. Kuiper, T.B.H. (Jet Propulsion Laboratory, California Institute of Technology); Zuckerman, B.; Kakar, R.K.; Kuiper, E.N.R. Astrophys. J. Lett. 200: No. 3, L151-L153 (15 Sept 1975).

Millimeter-wavelength radiation was seen in Sgr B2 at two frequencies which correspond to transitions between the $J=5/2$ and the $J=3/2$ Λ-doublet sublevels in the $^2\Pi_{1/2}$ state of nitrogen sulfide. If the radiation is due to this molecule, the hyperfine ratios may be anomalous. (auth)

10164 RECOMBINATION LINE OBSERVATIONS OF A NORMAL HELIUM ABUNDANCE IN THE GALACTIC-CENTER H II REGION SAGITTARIUS B2. Brown, R.L. (National Radio Astronomy Observatory); Lockman, F.J. Astrophys. J. Lett. 200: No. 3, L155-L159 (15 Sept 1975).

We have detected both the H 76α and He 76α recombination lines in the Sgr B2 H II region; from a comparison of the integrated power in these lines we infer that the ratio of ionized helium to ionized hydrogen in Sgr B2 is $\langle He^+/H^+\rangle=0.085\pm0.015$. These observations require that the hydrogen and helium Strömgren spheres be spatially coextensive. Hence if processes intrinsic to the H II region, such as dust absorption of Lyman continuum photons, compete effectively with the gas for the stellar ionizing radiation, then the dust opacity at the helium ionization threshold cannot exceed the dust opacity at the Lyman limit, $\tau_d(504\text{ Å})\leqslant\tau_d(912\text{ Å})$. The anomalously low He^+/H^+ ratio in Sgr B2 derived from recombination line observations at lower frequencies very likely results from preferential enhancement of the nebular hydrogen lines in the ionized component of the Sgr B2/molecular cloud interface. (auth)

10165 INFRARED GALAXIES: EVOLUTIONARY STAGES OF MASSIVE STAR FORMATION. Harwit, M. (Center for Radiophysics and Space Research, Cornell University); Pacini, F. Astrophys. J. Lett. 200: No. 3, L127-L129 (15 Sept 1975).

We cite evidence which indicates that infrared galaxies may represent evolutionary stages during which a large number of massive stars are being formed. The lifetime of these stars would be rather short (10^6–10^7 years), and the resulting supernova explosions could account for the level of non-thermal activity which often accompanies the thermal infared emission. (auth)

10166 SODIUM DEPLETION WITHIN DIFFUSE INTERSTELLAR CLOUDS. Jura, M. (Department of Astronomy, University of California, Los Angeles). Astrophys. J. 200: No. 2, 415-418 (1 Sept 1975).

Having derived estimates of the densities and radiation fields within several interstellar clouds from the observed populations of the H_2 rotational levels, we can estimate the amount of sodium and calcium depletion within different clouds. If the H_2 formation rate R equals 3×10^{-17} cm^3 s^{-1}, and if the hydrogen ionization rate is less than 10^{-16} s^{-1}, we find that in most clouds with $E(B-V)\leqslant0.10$, sodium is at most slightly depleted, while calcium is always substantially depleted. This result is important for determining the thermal equilibrium within diffuse interstellar clouds. (auth)

10167 THE FORMATION OF CARBON MONOXIDE AND THE THERMAL BALANCE IN INTERSTELLAR CLOUDS. Oppenheimer, M.; Dalgarno, A. (Center for Astrophysics, Harvard College Observatory). Astrophys. J. 200: No. 2, 419-425 (1 Sept 1975).

A chemical scheme is presented for the formation of carbon monoxide in interstellar clouds of low density which suggests that the conversion of C into CO is substantial at depths corresponding to visual extinctions exceeding unity. At temperatures near 80 K, the main source of CO is the reaction of ionized carbon with the OH radical, but at low temperatures a sequence initated by the radiative association of ionized carbon and molecular hydrogen is more efficient. Because of the enhanced cooling at low temperatures, the conversion of C to CO affects significantly the evolution of the cloud. We have solved the coupled time-dependent chemical and energy equations for the isochoric cooling of a cloud. The production of CO leads to the formation of a cold region in the cloud that may be unstable, and we suggest that the contraction of an interstellar cloud depends critically on the formation of CO and of other interstellar molecules. (auth)

10168 THE *V*-[2.2 μ] COLORS OF ELLIPTICAL GALAXIES. Frogel, J.A.; Persson, S.E. (Center for Astrophysics, Harvard College Observatory, Smithsonian Astrophysical Observatory); Aaronson, M.; Becklin, E.E.; Matthews, K.; Neugebauer, G. Astrophys. J. Lett. 200: No. 3, L123-L126 (15 Sept 1975).

Infrared photometric measurements of 19 normal and giant elliptical galaxies are presented. These measurements have been made with apertures of diameters ranging from 0.1 to 1.3 times the visual diameter. The derived *V*-[2.2 μ] colors range from 3.15 to 3.60 magnitudes, and show no significant radial dependence. These two results differ markedly from those of Grasdalen. (auth)

10169 CROSS SECTIONS FOR PHOTOIONIZATION OF VIBRATIONALLY EXCITED MOLECULAR HYDROGEN. Ford, A.L. (Department of Physics, Texas A and M, College Station, Texas); Docken, K.K.; Dalgarno, A. Astrophys. J. 200: No. 3, 788-789 (15 Sept 1975).

Cross sections are presented for the photoionization of vibrationally excited molecular hydrogen by radiation with wavelengths longer than 912 Å. (auth)

10170 INTERSTELLAR K I AND Na I ABSORPTION LINES NEAR RHO OPHIUCHI. Hobbs, L.M. (Yerkes Observatory, University of Chicago). Astrophys. J. 200: No. 3, 621-624 (15 Sept 1975).

Interferometric scans of the interstellar K I λ7699 and Na I D1 absorption lines have been obtained toward ρ Oph and *o* Sco, in the ρ Ophiuchi dark cloud. The scans reveal narrow, multiple lines toward ρ Oph. This multiplicity can explain the difference in radial velocity between the strong atomic absorption lines and the weak molecular lines in this direction, as observed at lower velocity resolution. In both directions the less saturated λ7699 lines yield K I column densities roughly consistent with the reddening. (auth)

10171 VELOCITY COMPONENT STRUCTURE OF THE ZETA OPHIUCHI INTERSTELLAR LINES. Crutcher, R.M. (Department of Astronomy, University of Illinois at Urbana-Champaign). Astrophys. J. 200: No. 3, 625-633 (15 Sept 1975).

Multivelocity component structure in the ξ Oph interstellar spectrum has been investigated by fitting theoretical profiles to available high-velocity resolution Na I, Ca II, and K I profiles. Evidence is presented for variable depletion of Ca, Ti, and K with respect to Na, with more severe depletion in the stronger velocity components. Effects of explicitly considering the velocity structure in constructing curves of growth are discussed; many of the interstellar column densities derived from *Copernicus* ultraviolet data are very sensitive to the exact form of the curve of growth. Either of two models for the distribution of interstellar absorbers toward ζ Oph seems consistent with the data. One model includes significant contributions to the lines of some elements by the H —— region toward ζ Oph, while the other calls for severe variable depletion among the neutral-region velocity components. (auth)

10172 A COMPARISON OF COLORS AND LINE STRENGTHS AT AND NEAR THE NUCLEUS OF M31. Spinrad, H.; Liebert, J.W. (Department of Astronomy, University of California, Berkeley). Astrophys. J. 200: No. 3, 582-583 (15 Sept 1975).

High-angular-resolution spectrophotometry shows that the energy distribution of the nucleus of M31 ($r\leqslant2''$) is only slightly redder and marginally more strong-lined than the surrounding nuclear bulge (measured 4'-E). No discontinuity in metallicity seems to be present. (auth)

10173 CONSTRAINTS ON THE MOLECULAR PROPERTIES OF INTERSTELLAR X-OGEN DERIVED FROM RADIO OBSERVATIONS. Hollis, J.M.; Snyder, L.E. (University of Virginia); Buhl, D.; Giguere, P.T. Astrophys. J. 200: No. 3, 584-593 (15 Sept 1975).

Twenty-eight X-ogen emission sources at 89.189 GHz have been detected and observed; of these, 20 are new X-ogen sources which also contain other interstellar molecules. No infrared stars were found to be X-ogen sources. A new rest frequency, 89,188.65 MHz, has been derived for X-ogen. We show that X-ogen is not SiC, C_2H, or any molecule with spin-doubling and/or hyperfine structure. (auth)

10174 DETECTION OF AN ADDITIONAL HYDROGEN RECOMBINATION LINE SOURCE AT THE W49A POSITION. Parrish, A. (National Radio Astronomy Observatory, Green Bank, West Virginia). Astrophys. J. 200: No. 3, 594-597 (15 Sept 1975).

New 166α and 248α radio recombination-line observations of the thermal source W49A display not only the expected lines characterized by the ~10 km s^{-1} radial velocity of the nebula, but also an additional hydrogen-carbon line pair that, kinematically, arises in a foreground object. The 248α lines are predominantly stimulated by the background continuum. The presence and intensity of the carbon line suggests that the object contains an H II region. In addition, limited 166 α line observations of the W49B position have yielded upper limits for the line intensities there. (auth)

10175 THE EFFECT OF SUPRATHERMAL PROTONS ON THE PHYSICAL CONDITIONS IN SEYFERT GALAXY NUCLEI. Ptak, R.; Stoner, R. (Department of Physics, Bowling Green State University). Astrophys. J. 200: No. 3, 558-566 (15 Sept 1975).

The physical conditions in a high-density hydrogen gas heated and ionized by suprathermal protons are investigated, with application to the gas in the nuclear region of Seyfert galaxies. The gas is assumed to be optically thick to Lyman and Balmer line radiation. Mechanisms by which the radiation from the gas can balance the heating by the fast protons are investigated, and minimum values for the mass of gas are estimated. Under certain conditions, the suprathermal atoms themselves can cool the ambient gas by rescattering the line radiation into the optically thick thin region in the wings of the line. This mechanism, which we call optical reverberation, can enhance the broad component of the hydrogen lines produced by inelastic atomic collisions and yield linewidths consistent with those observed in Seyfert and quasar spectra. If this mechanism is important, the Lyman decrement can depend strongly on the temperature and density of the ambient hydrogen. We also discuss the possibility of achieving dynamic equilibrium of the ambient gas by balancing the momentum transfer from the suprathermals with gravitational attraction of a massive central source. (auth)

10176 THE DISK OF THE SEYFERT GALAXY NGC 4151. Simkin, S.M. (Department of Astronomy and Astrophysics, Michigan State University). Astrophys. J. 200: No. 3, 567-573 (15 Sept 1975).

Spectroscopic observations of the "bar" in NGC 4151 show its continuous spectrum to have a large ultraviolet excess and no detectable stellar absorption features. The λ3727 [O II] line in emission leads to line-of-sight velocities for the ends of the bar of 35–55 km s^{-1} relative to the nucleus. Analysis of Hα, *U*, and deep IIIa-J plates indicates that the major axis of this galaxy is in P.A. 26°±3°.5 and its angle of inclination to the plane of the sky is 21°±5°. The most probable interpretation of the observations suggest that both large circular velocities (300–500 km s^{-1}) and radial streaming out into the disk (100–300 km s^{-1}) occur near the nucleus, with outward radial streaming of 60–100 km s^{-1} occurring out to a distance of 4 kpc in the bar. (auth)

10177 COLLISIONS OF GALAXIES IN DENSE CLUSTERS. I. DYNAMICS OF COLLISIONS OF TWO GALAXIES. Richstone, D.O. (Princeton University Observatory). Astrophys. J. 200: No. 3, 535-547 (15 Sept 1975).

Collisions of spherical galaxies composed only of stars were simulated numerically. Test stars representative of the model galaxy were selected by a Monte Carlo technique and followed through the collision by integrating their equations of motion, within the approximations that the stars react only to the smoothed-out mass distributions of the galaxies, and that those distributions are unchanged during the collision. Approximate analytic arguments based on the impulsive approximation have been used to extend the numerical results. These computer and analytic studies have been used to obtain cross sections for certain processes which may be important in dense clusters of galaxies. Although detailed application of these results to clusters is reserved for a later paper, we note already that if the galaxies in the center of the Coma cluster were initially 50 kpc or more in radius, then they have suffered substantial changes in mass and radius over the age of the Universe. (auth)

10178 INTERSTELLAR CIRCULAR POLARIZATION. II. NORTHERN AND SOUTHERN HEMISPHERE SURVEY RESULTS AND OBSERVATIONAL SEARCH CRITERIA. Avery, R.W.; Stokes, R.A. (Battelle-Northwest Laboratories, Richland, Washington 99352); Michalsky, J.J.; Ekstrom, P.A. Astron. J. 80: No. 12, 1026-1030 (Dec 1975).

Our original survey has been extended to include more northern and southern hemisphere stars; the wavelength coverage was extended and the precision improved for several previously observed stars. Search criteria for interstellar circular polarization based on the linear polarization and reddening have been delineated and refined. Observational data are presented which confirm the theoretical prediction that the wavelength of maximum interstellar linear polarization and the wavelength of the zero crossing of interstellar circular polarization are approximately the same. An intercomparison of the results of various authors is presented and briefly discussed. (auth)

10179 DYNAMICS OF EARLY TYPE GALAXIES. I. THE ROTATION CURVE OF THE ELLIPTICAL GALAXY NGC 4697. Bertola, F.; Capaccioli, M. (Asiago Astrophysical Observatory, University of Padova). Astrophys. J. 200: No. 2, 439-445 (1 Sept 1975).

The rotation curve, up to 0'.6 from the center, has been derived from Ca II H and K lines for the elliptical galaxy NGC 4697. A maximum seems to be reached at 15" with 65 km s^{-1}. The same galaxy has been investigated by means of photographic photometry in the *B* system. The luminosity profile follows the $r^{1/4}$ law, and the mean ellipticity is 0.4. The total apparent magnitude is $B=10.30$ mag, and the corresponding absolute magnitude reaches $M_B = 20.5$ mag, assuming a distance of 14.8 Mpc. The spatial velocity curve and the light density profile are derived. Mass and angular momentum have been computed on the hypothesis that the mass-to-light ratio is constant through the galaxy, leaving it as a free parameter. Under several assumptions it is found that the angular momentum of the elliptical NGC 4697 is lower than that of a spiral of comparable mass by a factor 5 to a factor 30, when the mass-to-light ratio varies from 5 to 50. (auth)

10180 Hα EMISSION-LINE GALAXIES IN A SOUTH GALACTIC POLAR REGION. Sanduleak, N.; Pesch, P. (Warner and Swasey Observatory, Case Western Reserve University). Astrophys. J. 200: No. 2, 446-449 (1 Sept 1975).

Nine new Hα emission-line galaxies have been found in a region near the South Galactic Pole. (auth)

Cosmology

Refer also to abstracts 9991, 10037, 10068, 10154, 10187, and 10216.

10181 DID CHINESE COSMOLOGY ANTICIPATE RELATIVITY. Gribbin, J. Nature (London); 256: No. 5519, 619–620 (21 Aug 1975).

It is stated that recent interest in historic novae and supernovae, stimulated by the discovery of pulsars, has shown the value of ancient Chinese astronomical observations. But the Chinese also have a long record of "cosmological" theorizing; in some cases their old concepts regarding the Universe are remarkably similar to those developed in the West during the twentieth century. (auth)

10182 MODELS OF THE UNIVERSE IN GENERAL RELATIVITY. Krasinski, A. (Zaklad Astronomii PAN, Warsaw). Postepy Astron.; 23: No. 2, 97-110(1975). (In Polish)

Some difficulties of the Newtonian theory of gravitation which led to the formulation of the general relativity theory are presented. Then the basic ideas of general relativity are introduced at an elementary level. The properties of a few most important cosmological models are briefly discussed. These are: the static Einstein Universe, Friedman models, Milne-McCrea's Newtonian cosmology and the steady state theory. Arguments for and against each model are briefly summarized. History of the Universe according to Friedman models is described. Finally, Dirac's "Large Numbers Universe" and Wheeler's "Reprocessing Universe" are presented as examples of to date speculations. (auth)

10183 CAN COLLAPSED STARS CLOSE THE UNIVERSE? Thorstensen, J.R.; Partridge, R.B. (Haverford College, Haverford, Pennsylvania). Astrophys. J. 200: No. 3, 527-534 (15 Sept 1975).

Can black holes and other collapsed objects contribute enough mass to close the Universe (i.e., to bring the density of the Universe up to the critical density, ρ_c) ? If the black holes are the collapsed remnants of an early generation of massive stars, current observations of the nightsky brightness may be used to place an upper limit on the mass contributed by such objects. We show that the density contributed by collapsed objects must be less than 0.01 ρ_c unless the stars formed before an epoch of 10^9 yr ($z>5$). Even more stringent limits may be set for many of the models considered below. (auth)

10184 CONDITIONS FOR FITTING A FRIEDMANN UNIVERSE TO EMPTY SPACE. Korkina, M.P. (Dnepropetrovsk University). Sov. Astron.—AJ 19: No. 2, 185-188 (Sept 1975).

The fitting conditions between a spherically symmetric universe of dustlike material and empty space are considered. The Lichnerowicz conditions are tested, as well as the possibility of identifying the coordinates of the internal and external metrics for various solutions (including those of Hoyle and Narlikar, Oppenheimer and Snyder, and Novikov). An external solution satisfying all the necessary requirements is proposed; it is matched to a Friedmann internal solution. (auth)

10185 THE GENERATION OF GRAVITATIONAL WAVES. I. WEAK-FIELD SOURCES. Thorne, K.S.; Kovács, S.J. (California Institute of Technology). Astrophys. J. 200: No. 2, 245-262 (1 Sept 1975).

This paper derives (§§ II—IV) and summarizes (§ VI) a new "plug-in-and-grind" formalism (i.e., an algorithm) for calculating the gravitational waves emitted by any system with weak internal

gravitational fields. If the internal fields have negligible influence on the system's motions, then the new formalism reduces to standard "linearized theory." Whether or not gravity affects the motions, if the motions are slow and internal stresses are weak, then the new formalism reduces to the standard "quadrupole-moment formalism" (§ V). In the general case the new formalism expresses the radiation in terms of a retarded Green's function for slightly curved spacetime, and then breaks the Green's function integral into five easily understood pieces: *direct radiation*, produced directly by the motions of the source; *whump radiation*, produced by the "gravitational stresses" of the source; *transition radiation*, produced by a time-changing time delay ("Shapiro effect") in the propagation of the nonradiative, $1/r$ field of the source; *focusing radiation*, produced when one portion of the source focuses, in a time-dependent way, the nonradiative field of another portion of the source; and *tail radiation*, produced by "backscatter" of the nonradiative field in regions of focusing. (auth)

10186 GRAVITATIONAL RADIATION AND GRAVITATIONAL COLLAPSE: PROCEEDINGS OF THE SYMPOSIUM, WARSAW, POLAND, SEPTEMBER 5–8, 1973. Dewitt-Morette, C. (ed.). IAU Symposium, No. 64. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974). 239p. $30.24.

Recent theoretical and experimental work on gravitational radiation, (possible sources and detectors), stability and collapse, and the accretion of matter and x-ray sources is presented in a number of papers. Some of the topics covered include mechanisms of emission and absorption of gravitational radiation, the prospects for high-sensitivity gravitational antennae, the stability of relativistic systems, properties of black holes relevant to their observation, and the accretion of matter on relativistic systems. (IAA)

Planetary Phenomena

Refer also to abstracts 10027, 10037, 10142, 10218, 10221, 10245, and 11015.

10187 EFFECT OF TIDAL FORCES ON THE STABILITY AND DISPERSAL RATES OF A PROTOPLANET. Donnison, J. R.; Williams, I. P. (Queen Mary Coll., London). Mon. Not. R. Astron. Soc.; 172: No. 2, 257-269(Aug 1975).

The tidal disruption of a protoplanet by the Sun is considered by both analytical and numerical means. It is concluded that the disruption process is very rapid and that this implies that most conventional protoplanetary theories for the formation of planets need to be modified; otherwise, complete disruption would have occurred before a refractory core could form. (auth)

10188 DOUBLE STRUCTURE IN THE OUTER ELECTRON RADIATION BELT DURING GEOMAGNETIC ACTIVITY. Kirsch, E. (Max-Planck-Institut fuer Aeronomie, Lindau/Harz, Ger.); Muench, J. W.; Scholer, M. Planet. Space Sci.; 23: No. 6, 913-921(Jun 1975).

With the German research satellite AZUR a double structure lasting from 6 to 8 days was observed repeatedly at low altitudes in the outer electron radiation belt, which is very distinct for energies > 3.2 MeV. This phenomenon is discussed for a small and large geomagnetic storm by using simultaneous measurements of the geosynchronous ATS 5 satellite and magnetograms of polar stations. The double structure can probably be explained by a loss mechanism for relativistic electrons near the plasmapause due to a parasitic cyclotron interaction process with ion-cyclotron waves proposed by Thorne and Kennel. The example with the large geomagnetic storm also gives evidence for the injection and acceleration of high energy electrons in the outer radiation belt. (auth)

10189 MODE DECAY AND GRADIENT IN THE INTERPLANETARY MAGNETIC FIELD FLUCTUATION SPECTRUM. Cohen, R. H. (Princeton Univ., NJ). pp 291-293 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

10190 RADIAL GRADIENTS IN THE INTERPLANETARY MAGNETIC FIELD BETWEEN 1.0 AND 4.3 AU. Smith, E. J. (California Inst. of Tech., Pasadena). pp 257-280 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

10191 THERMODYNAMICS AND PHASE SEPARATION OF DENSE FULLY IONIZED HYDROGEN-HELIUM FLUID MIXTURES. Stevenson, D.J. (Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, New York 14853). Phys. Rev. B 12: No. 10, 3999-4007 (15 Nov 1975).

The free energy of a hydrogen-helium fluid mixture is evaluated for the temperatures and densities appropriate to the deep interior of a giant planet such as Jupiter. The electrons are assumed to be fully pressure ionized and degenerate. In this regime, an appropriate first approximation to the ionic distribution functions can be found by assuming hard-sphere interactions. Corrections to this approximation are incorporated by means of the perturbation theory of Anderson and Chandler. Approximations for the three-body interactions and the nonlinear response of the electron gas to the ions are included. We predict that a hydrogen-helium mixture, containing 10% by number of helium ions, separates into hydrogen-rich and helium-rich phases below about 8000 °K, at the pressures relevant to Jupiter (4–40 Mbar). We also predict that the alloy occupies less volume per ion than the separated phases. The equation of state and other thermodynamic derivatives are tabulated. The implications of these results are mentioned. (auth)

10192 DETECTION OF CARBON MONOXIDE IN JUPITER. Beer, R. (Space Sciences Division, Jet Propulsion Laboratory). Astrophys. J. Lett. 200: No. 3, L167-L169 (15 Sept 1975).

New, ground-based, 5-μ spectra of Jupiter have revealed the presence of a trace quantity of carbon monoxide in the lower atmosphere of the planet. A preliminary analysis suggests a number mixing ratio in the neighborhood of 10^{-9} and a column abundance of roughly 5×10^{17} molecules cm^{-2} to a depth of at least 2 atmospheres. It is suggested that the observation might be confirmed by microwave techniques. (auth)

10193 POSSIBLE NEW JOVIAN THERMOSPHERIC MODELS. Prasad, S.S. (Jet Propulsion Laboratory, California Institute of Technology). Astrophys. J. Lett. 200: No. 3, L171-L174 (15 Sept 1975).

Possibilities of models for the Jovian thermosphere, based upon mechanical heating, have been explored. Under certain reasonable assumptions about the magnitude of the critical Richardson number, the correction to the conventional expression for the eddy heat flux, and the height dependence of the eddy diffusion coefficient, a very hot thermosphere could result, yielding exospheric temperatures more in tune with the bounds being suggested by the recent optical and radio occultation experiments. (auth)

10194 MICROMETER OBSERVATIONS OF (433) EROS. Heintz, W.D. (Department of Astronomy, Swarthmore College). Astrophys. J. 200: No. 3, 787-787 (15 Sept 1975).

The orientation and elongation of the minor planet Eros was observed in 12 nights of the 1975 apparition. (auth)

10195 CORRECTIONS TO THE AZIMUTHAL COMPONENT OF THE INTERPLANETARY MAGNETIC FIELD DUE TO MERIDIONAL FLOW IN THE SOLAR WIND. Nerney, S.F.; Suess, S.T. (Space Environment Laboratory, National Oceanic and Atmospheric Administration, Boulder). Astrophys. J. 200: No. 2, 503-509 (1 Sept 1975).

Stellar-wind models which incorporate meridional flows, open magnetic flux tubes in the equatorial plane of the star. The transport of magnetic field to higher latitudes is accompanied by an increase in the azimuthal velocity, increasing the corotation of the plasma at all latitudes. The percentage correction to the azimuthal magnetic field compared to classical models is a 10–20 percent effect at 5 AU and $\theta=90°$, whereas the azimuthal velocity correction is a 20–40 percent effect. The model is compared with recent observations from *Pioneer* 10 which may indicate that the azimuthal magnetic field is not as large near Jupiter as suggested by classical two-dimensional models. (auth)

10196 EFFECT OF VELOCITY DISPERSION OF IRREGULARITIES ON THE TEMPORAL SPECTRA OF INTERPLANETARY SCINTILLATIONS. Chashei, I.V. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR). Sov. Astron.—AJ 19: No. 2, 223-225 (Sept 1975).

The effect of the velocity dispersion of the irregularities on the temporal spectrum of interplanetary scintillations is investigated. It is shown that in the case of the extended power-law spectrum of the electron density fluctuations the velocity dispersion does not change the asymptotic form of the temporal spectrum of the scintillations. In the case of Gaussian spectrum of the irregularities and fairly strong velocity dispersion the form of the temporal spectrum of the scintillations may differ appreciably from the spatial spectrum. The velocity dispersion of irregularities that occurs in the interplanetary plasma is insufficient for any significant change in the form of the scintillation spectrum. (auth)

10197 POSSIBILITY OF MEASURING PARAMETERS OF LARGE-SCALE INHOMOGENEITIES OF THE INTERPLANETARY PLASMA BY RADIO ASTRONOMICAL METHOD. Shishov, V.I. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR). Sov. Astron.—AJ 19: No. 2, 226-228 (Sept 1975).

The possibility of measuring the effect of refraction on large-scale inhomogeneities of the interplanetary plasma by ground-based radio-astronomical observations is investigated. The method is based on the measurement of the displacement of the scintillation pattern of a source

at two frequencies, which is caused by the refraction effect. The magnitudes of the displacement due to refraction at the gradient of the mean electron density and at large inhomogeneities with 10^9 cm scale are estimated. (auth)

10198 THE FIGURE OF MARS. Meshcheryakov, G.A. (Geodesic Department, L'vov Polytechnic Institute). Sov. Astron.—AJ 19: No. 2, 229-231 (Sept 1975).

The triaxial ellipsoid, approximating the areoid, and Clairaut spheroid are constructed on the basis of the Stokes constants of Mars obtained from radio measurements of the Mariner 9 trajectory. The flattening of Mars is discussed. (auth)

10199 OCCULTATION OF β_1 SCO BY JUPITER ON MAY 14, 1971. Taranova, O.G. (P. K. Shternberg State Astronomical Institute). Sov. Astron.—AJ 19: No. 2, 232-235 (Sept 1975).

Results of the observation and analysis of the occultation of the spectral binary β_1 Sco by Jupiter on May 14, 1971 are presented. It is found that the scale height of Jupiter's upper atmosphere is 22 km and the temperature is 137°K ($\mu=2$) and 178°K ($\mu=2.6$). The concentration at the 0.5 level is $N_{0.5} = \{5 \cdot 10^{13}\ \text{cm}^{-3}, \mu = 2, 6.5 \cdot 10^{13}\ \text{cm}^{-3}, \mu = 2.6$. The existence of at least two layers with scale heights of 18 and 15 km is assumed. The thickness of each layer is $\sim H_0$. (auth)

10200 PROSPECTS FOR UTILIZING LIGHT-RANGING (LASER) OBSERVATIONS OF THE MOON. Abalakin, V.K.; Boiko, V.N.; Kokurin, Yu.L.; Lobanov, V.F.; Fursenko, M.A. (Institute of Theoretical Astronomy, Academy of Sciences of the USSR). Sov. Astron.—AJ 19: No. 2, 236-241 (Sept 1975).

Estimates of the expected accuracy in the determination of some astronomical and geodesic parameters from light-ranging (laser) observations of the moon are examined. The analysis is based on an examination of the appropriate covariance (inverse) matrices of the normal equations constructed for several cases differing from one another in the number of laser retro-reflectors observed on the moon and the number of observatories and in the duration and intensity of the laser measurements of the earth—moon distances. (auth)

10201 POSSIBILITY OF CARTOGRAPHY OF THE COMPLEX OF OPTICAL CHARACTERISTICS OF THE MOON. Evsyukov, N.N. (Astronomical Observatory, Khar'kov University). Sov. Astron.—AJ 19: No. 2, 242-244 (Sept 1975).

The possibility of cartography of the complex of optical characteristics of the moon by the method of photographic photometry is shown. (auth)

10202 QUASIPERIODIC INTERMEDIATE ORBITS OF THE MAJOR PLANETS AND ZERO-ORDER RESONANCES. Brumberg, V.A.; Evdokimova, L.S.; Skripnichenko, V.I. (Institute of Theoretical Astronomy, Academy of Sciences of the USSR). Sov. Astron.—AJ 19: No. 2, 255-260 (Sept 1975).

Particular quasiperiodic solutions of the equations of motion of the major planets in rectangular heliocentric coordinates are constructed by successive iterations relative to the planetary masses. These solutions are presented in the form of exponential series in multiples of the mean longitudes of the planets with the sum of all exponential indices in each term equal to zero. The corresponding inequalities in the motion of the planets are of zero order relative to the eccentricities and inclinations of the planetary orbits. The resonance terms produced by the close commensurabilities between three or more mean motions of the planets are brought out. These resonance terms are of zero order relative to the eccentricities and inclinations. Relative to the planetary masses they are at least of second order in their analytical structure, although in numerical value they are comparable with first-order terms. (auth)

10203 IMPROVEMENT OF THE FUNDAMENTAL-CATALOG SYSTEM FOR MINOR-PLANET OBSERVATIONS. Boiko, V.N. (Institute of Theoretical Astronomy, Academy of Sciences of the USSR, Leningrad). Sov. Astron.—AJ 19: No. 2, 261-266 (Sept 1975).

Hypothetical sets of optical and radar observations of minor planets are investigated to ascertain the accuracy with which corrections to the orbital elements of the earth and the minor planets can be determined, as well as corrections in the equinox and equator, and systematic errors in the fundamental-catalog system. The mutual correlation of the unknown quantities is examined. Conditions are set forth whereby the accuracy of the equinox correction can be improved. (auth)

10204 A MODEL FOR IO's ATMOSPHERE AND SODIUM CLOUD. Macy, W. Jr.; Trafton, L. (The University of Texas, Austin). Astrophys. J. 200: No. 2, 510-519 (1 Sept 1975).

Observations of the sodium D-line emissions associated with the Galilean satellite Io suggest that the emitting region has two components. The first is an atmosphere which extends 10^3 km above Io's surface. This is a relatively dense region which is optically thick in the sodium D lines. The second component is a surrounding, optically thin cloud spread out along Io's orbit to form part of a torus. We detected no emission during any of three eclipses observed, although Io's sodium emission was consistently present when Io was near orbital elongation. This indicates that resonant scattering is the principal emission mechanism in both components. For the atmosphere, measurements of the D-line intensity, D_2/D_1 ratio, and line width indicate a temperature of 500 to 1000 K and a sodium column abundance of 3×10^{13} cm^{-2}. Upper limits to the abundance of Mg, K, Ca, and Li indicate a high sodium abundance ratio in the atmosphere. This may also be true for Io's surface if sputtering by energetic particles is the source of the atmosphere. We have detected the cloud as far as 60 arcsec from Io in the orbital plane and at least 6 arcsec above and below this plane. The cloud can be sustained by atoms escaping from the critical level at the top of the atmosphere. (auth)

10205 THE EVOLUTION OF EARLY PRECAMBRIAN CRUSTAL ROCKS OF ISUA, WEST GREENLAND-GEOCHEMICAL AND ISOTOPIC EVIDENCE. Moorbath, S.; O'Nions, R. K.; Pankhurst, R. J. (Oxford Univ. (UK). Dept. of Geology and Mineralogy). Earth Planet. Sci. Lett.; 27: No. 2, 229-239(Sep 1975).

Petrographic and chemical evidence suggests that boulders from a conglomeratic unit in the Isua supracrustal succession were derived by the erosion of an acid volcanogenic sediment. Six samples of the boulders and surrounding matrix yield a Rb-Sr whole rock isochron with a slope corresponding to an age of 3860 ± 240 m.y. (2 σ error), but consideration of the initial $^{87}Sr/^{86}Sr$ ratio constrains the possible age of formation of 3710 + 0− 90 m.y. This is in general agreement with a published Pb/Pb age of 3760 ± 70 m.y. on Isua banded ironstones. (NL)

10206 ANNEALING OF FISSION TRACKS IN ZIRCONS. Nishida, T.; Takashima, Y. (Kyushu Univ., Fukuoka (Japan). Faculty of Science). Earth Planet. Sci. Lett.; 27: No. 2, 257-264(Sep 1975).

Etching conditions and thermal annealing have been studied for fission tracks in four kinds of zircons. The observation of fission tracks under an optical microscope was made with respect to the mean pit length as well as the mean pit density. Apparent rate constants were obtained by substituting the isochronal (60 minutes) annealing data into the ordinary equation of the rate constant. The order of reaction (almost 3rd or 4th) and the activation energy (1.7−2.9 eV) of annealing were determined from the Arrhenius plot of the apparent rate constants. (NL)

10207 Rb-Sr WHOLE-ROCK STUDY OF THE PRECAMBRIAN ROCKS OF THE PEDERNAL HILLS, NEW MEXICO. Mukhopadhyay, B.; Brookins, D. G.; Bolivar, S. L. (New Mexico Univ., Albuquerque (USA)). Earth Planet. Sci. Lett.; 27: No. 2, 283-286 (Sep 1975).

Rb-Sr whole-rock investigation of the Pedernal Hills, New Mexico, indicates a 1471 ± 97 m.y. date for the granites and 1364 ± 27 m.y. date for the schists and quartzite (country rocks) with initial $^{87}Sr/^{86}Sr = 0.7060 \pm 0.0040$ and 0.7046 ± 0.0019 respectively. The schists and quartzites are older than the granites based on field and petrographic evidence. The open system nature of these rocks during the cataclastic metamorphism which affected both the country rocks and the granites is responsible for the apparent younger date of the schists and quartzite, and the 1471 ± 97 m.y. date may be a minimum age for the granites. (NL)

10208 INITIAL $^{87}Sr/^{86}Sr$ RATIOS OF PLUTONIC AND VOLCANIC ROCKS OF THE ANDES BETWEEN LATITUDES 26° AND 29° SOUTH. McNutt, R. H.; Crocket, J. H. (McMaster Univ., Hamilton, Ontario (Canada). Dept. of Geology); Clark, A. H.; Caelles, J. C.; Farrar, E.; Haynes, S. J.; Zentilli, M. (Queen's Univ., Kingston, Ontario (Canada). Dept. of Geological Sciences). Earth Planet. Sci. Lett.; 27: No. 2, 305-313(Sep 1975).

Initial $^{87}Sr/^{86}Sr$ ratios have been determined for 34 plutonic and volcanic rocks covering the entire age span of magmatic events associated with the Andean orogeny between latitudes 26° and 29° south. The igneous rocks, the majority dated by K/Ar mineral techniques, range in age from Lower Jurassic (190 m.y.) to Quaternary (0.89 m.y.). In addition initial ratios were determined for three granitoid plutons and one metasediment from the pre-Mesozoic basement which underlies the entire Andean orogeny in this transect at shallow depth. The compositions vary from basalt to rhyolite, and from quartz diorite to granodiorite or trondjemite, for the extrusive and intrusive, respectively. Mid-Cretaceous to Quaternary rocks exhibit a systematic west to east increase in mean strontium isotope ratio from 0.7022 to 0.7077, whereas the initial ratios of Jurassic plutons vary from 0.7043 to 0.7059 and not correlate with age. The existence of unusually low initial ratios (e.g. 0.7022, 0.7023) for several Mesozoic plutonic rocks strongly implies a sub-crustal source for at least some of the Andean magmas. The time-dependent post-Jurassic increase in initial ratio is considered to reflect a systematic change in the composition of partial melts generated in response to the progressive subduction of a lithospheric slab. It is suggested that a systematic change in the locus of melting takes place from

along or close to the upper surface of the subduction slab into hanging-wall mantle peridotite as subduction continues. (NL)

10209 EXCESS ^{234}U: AN AGING EFFECT IN CONFINED WATERS. Kronfeld, J.; Gradsztajn, E.; Mueller, H. W.; Radin, J.; Yaniv, A.; Zach, R. (Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy). Earth Planet. Sci, Lett.; 27: No. 2, 342-345(Sep 1975).

Strong isotopic fractionation between ^{234}U and ^{238}U has been noted in deep oil-well brines. The waters are stratigraphically and structurally isolated from freshwater inflow and have remained stagnant for more than five half lifes of ^{234}U. Excess ^{234}U is explained by the ^{234}Th α-recoil nucleus event. (NL)

10210 HEAVY ELEMENT AFFINITIES IN APOLLO 17 SAMPLES. Allen, R. O. Jr.; Jovanovic, S.; Reed, G. W. Jr. (Argonne National Lab., Ill. (USA)). Earth Planet. Sci. Lett.; 27: No. 2, 163-169(Sep 1975).

^{204}Pb, Bi, Tl and Zn in samples from Apollo 17 exhibit relationships not found in samples from other sites. ^{204}Pb, Tl and Zn in residues remaining after dilute acid leaching are correlated with one another. Orange soil 74220, which is enriched in ^{204}Pb, Tl and Zn, is included in these relationships. In addition the submicron metallic phase generally associated with agglutinate formation is correlated with all three of these elements; this relationship has already been reported for ^{204}Pb in other samples. Thus, orange soil and agglutinates appear to be involved in concentrating heavy volatile metals. A process other than mixing is required to account for this. As a consequence of the isolation of the landing site by the surrounding massifs, local supply and recycling of volatile trace elements in soils may account for some of the interelement relations. (NL)

10211 LEAD ISOTOPIC STUDY OF APLITES FROM THE PRECAMBRIAN BASEMENT ROCKS NEAR IBADAN, SOUTHWESTERN NIGERIA. Oversby, V. M. (Australian National Univ., Canberra. Research School of Earth Sciences). Earth Planet. Sci. Lett.; 27: No. 2, 177-180(Sep 1975).

Pb isotopic compositions for three total-rock samples of aplite and their constituent K-feldspars from the Nigerian basement assemblage near Ibadan show lead homogenization during the Pan-African thermo-tectonic event. A secondary isochron formed by the K-feldspars data points is used to calculate a primary age of about 2750 m.y. for the aplites. The aplites do not register any Pb isotopic effect from the intrusion of granite gneiss in the area at 2330 m.y. (NL)

10212 ^{40}Ar-^{39}Ar CHRONOLOGY OF ISOLATED PHASES FROM BUNUNU AND MALVERN HOWARDITES. Rajan, R. S.; Huneke, J. C.; Smith, S. P.; Wasserburg, G. J. (California Inst. of Tech., Pasadena (USA). Div. of Geological Sciences). Earth Planet. Sci. Lett.; 27: No. 2, 181-190(Sep 1975).

High resolution ^{40}Ar-^{39}Ar age spectra have been measured on plagioclase and glass from two howardites. Both the plagioclase and glass from the gas-rich Bununu howardite show well-defined age plateaux, yielding distinct ages of 4.42 ± 0.04 and 4.24 ± 0.05 AE, respectively. These age patterns are rather well behaved and are interpreted as representing the distinct times of formation of plagioclase from igneous processes and of glass fragments produced by impact on the meteorite body. The release pattern for the glass from the heavily shocked Malvern howardite is undulating at low and intermediate temperatures but does have a high-temperature plateau. Its age spectrum indicates little apparent diffusion loss, but rather an extensive redistribution of either ^{40}Ar during the shock event or of ^{39}Ar during the neutron irradiation or both. The total K-Ar age of Malvern glass is 3.64 ± 0.04 AE and the high-temperature plateau is 3.73 ± 0.05 AE. The age spectrum of the Malvern plagioclase has an intermediate temperature "plateau" at 3.80 AE that represents 20% of the total ^{40}Ar content and increases towards a high-temperature plateau at 4.29 ± 0.04 AE containing 26% of the total gas release. It seems likely that the event which formed the Malvern glass also reset part of the plagioclase. The distinct histories observed for the different phases of these howardites are consistent with their formation from a regolith. The present results along with similar young ages for igneous clasts from Kapoeta clearly show that the regoliths were extant on the parent bodies of howardites and that they were subjected to violent impact events at least as recent as 3.7 AE ago. (NL)

10213 COSMOGENIC NEON PRODUCED FROM SODIUM IN METEORITIC MINERALS. Smith, S. P.; Huneke, J. C. (California Inst. of Tech., Pasadena (USA). Div. of Geological Sciences). Earth Planet. Sci. Lett.; 27: No. 2, 191-199(Sep 1975).

Cosmogenic neon in sodium-rich oligoclase feldspar from the ordinary chondrites St. Severin and Guarena is characterized by an unusually high $^{22}Ne/^{21}Ne = 1.50 \pm 0.02$. This high ratio is due to the cosmogenic $^{22}Ne/^{21}Ne$ production ratio in sodium which is 2.9 ± 0.3, two to three times the production ratio in any other target element. The relative production rate of ^{21}Ne per gram sodium is one quarter the production rate per gram magnesium. The striking enrichment of ^{22}Ne relative to ^{21}Ne in sodium arises from enhanced indirect production from ^{23}Na via ^{22}Na. The unusual composition of cosmogenic neon in sodium and sodium-rich minerals explains the high $^{22}Ne/^{21}Ne$ ratios observed in inclusions of the Allende carbonaceous chondrite, and observed during low temperature extractions of neon from ordinary chondrites. The isotopic composition of cosmogenic neon released during the stepwise heating of a trapped gas-rich meteorite containing sodium-rich phases can be expected to vary, and use of a constant cosmogenic neon composition to derive the composition of the trapped gas may not be justified. Preferential loss of this ^{22}Ne-enriched cosmogenic neon from meteoritic feldspar can result in a 2-3% drop in the measured cosmogenic $^{22}Ne/^{21}Ne$ ratio in a bulk meteorite sample. This apparent change in composition can lead to overestimation of the minimum pre-atmospheric mass of the meteorite by a factor of two. (NL)

10214 PIONEER SOLAR PLASMA AND MAGNETIC FIELD MEASUREMENTS IN INTERPLANETARY SPACE DURING AUGUST 2–17, 1972. Mihalov, D. J.; Colburn, D. S.; Collard, H. R.; Smith, B. F.; Sonett, C. P.; Wolfe, J. H. (Ames Research Center, Moffett Field, CA). pp 545-553 of Correlated Interplanetary and Magnetospheric Observations. Page, D. E. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From 7th ESLAB conference on correlated interplanetary and magnetospheric observations; Saulgau, Ger. (22 May 1973).

10215 LUNAR NEUTRON SOURCE FUNCTION. Kornblum, J. J. Stony Brook, NY; State Univ. of New York (1974). 192p. University Microfilms Order No. 75-16,205.

Thesis (Ph. D.).

The search for a quantitative neutron source function for the lunar surface region is justified because it contributes to our understanding of the history of the lunar surface and of nuclear process occurring on the moon since its formation. A knowledge of the neutron source function and neutron flux distribution is important for the interpretation of many experimental measurements. This dissertation uses the available pertinent experimental measurements together with theoretical calculations to obtain an estimate of the lunar neutron source function below 15 MeV. Based upon reasonable assumptions a lunar neutron source function having adjustable parameters is assumed for neutrons below 15 MeV. The lunar neutron source function is composed of several components resulting from the action of cosmic rays with lunar material. A comparison with previous neutron calculations is made and significant differences are discussed. Application of the results to the problem of lunar soil histories is examined using the statistical model for soil development proposed by Fireman. The conclusion is drawn that the moon is losing mass. (Diss. Abstr. Int., B)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

Refer also to abstract 9990.

10216 (LBL-4188) OBSERVATION OF THE SUBMILLIMETER COSMIC BACKGROUND SPECTRUM. Woody, D. P. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 13 Nov 1975. Contract W-7405-ENG-48. 155p. Dep. NTIS $6.75.

Thesis.

An experimental measurement of the spectrum of the submillimeter cosmic background radiation is described. The experiment consists of measuring the night sky emission at an altitude of 39 km, correcting for the atmospheric molecular line emission, and placing limits on the contamination from sources of continuum radiation such as the apparatus itself and the earth. The observations were made on 24 July 1974 using a fully calibrated liquid-helium-cooled balloon-borne spectrophotometer. Important features of the apparatus include a cooled antenna, a polarizing interferometer, and a germanium bolometric detector. The characterization of the spectrophotometer includes the large angle response and emission of the antenna. The calibration of the instrument and corrections to the observed sky spectrum are based on measurements made during the flight. A simple model of the molecular line emission is used to determine the atmospheric contribution. The resulting spectrum covers the frequency range from 4 to 17 cm^{-1} and establishes that the cosmic background radiation follows the high frequency quantum cutoff for a 3K blackbody. A blackbody temperature of $2.99^{+.07}_{-.14}$ K is deduced from our data. The present status of the cosmic background observations, which span more than three decades in frequency, is analyzed and it is concluded that they are all consistent with a blackbody temperature of 2.90 +- .04K (+-1 sigma). This firmly supports the Big Bang cosmological model of the universe. (auth)

10217 MORPHOLOGY OF AURORAL-ZONE X-RAY EVENTS. IV. Substorm-Related Electron Precipitation in the Local Morning Sector. Kangas, J. (Oulu Univ., Finland); Lukkari, L.; Tanskanen, P.; Trefall, H.; Stadsnes, J.; Kremser, G.; Riedler, W. J. Atmos. Terr. Phys.; 37: No. 10, 1289-1303(Oct 1975).

Electron precipitation events on the morning side of the auroral zone have been surveyed by means of balloon measurements of X-ray bremsstrahlung events made in Northern Scandinavia and by comparison of these with riometer measurements from stations in North America. The morning events seem to be a manifestation of isolated substorms of medium activity level. A close correlation was found between the midnight and morning sectors, in particular when the energy spectral variations were carefully examined. The midnight precipitation pattern characterizes the source of energetic electrons giving rise to the morning precipitation. The development of the latter type of events is consistent with the drifting rain cloud model. Variable time delays between the Canadian and Scandinavian sectors may be attributed mainly to changes in the source location of electrons reaching Scandinavia. The possible role of magnetospheric electric fields and ionospheric cold plasma flow into the magnetosphere has also been considered. (auth)

10218 NORTH-SOUTH COMPONENT OF THE INTERPLANETARY MAGNETIC FIELD AND LARGE SCALE AURORAL DYNAMICS. Akasofu, S. I. (Univ. of Alaska, College). Nature (London); 256: No. 5514, 191-192(17 Jul 1975).

It is stated that controversy exists concerning the role of the N-S component, B_z, of the interplanetary magnetic field in magnetospheric processes, and particularly magnetospheric substorm processes. It has been generally thought that one southward turning of this component leads directly to growth processes that trigger the expansive phase of substorms. On the other hand, auroral observations along the meridian chain of stations in Alaska have shown that substorms frequently occur along a contracted auroral oval even when the B_z component is directed northward. Recently available large-scale auroral photographs taken from the DMSP satellite, and interplanetary magnetic field data from the HEOS satellite, for corresponding periods, are employed here in an endeavour to settle this controversy. It seems that the occurrence of substorms does not depend on the size of the auroral oval, except for periods when the oval contracts to its minimum size, and also does not depend on the sign of the B_z component. Magnetospheric properties that can be inferred from these findings, as controlling factors for the occurrence of substorms, are discussed, together with theoretical implications. (UK)

10219 PRESENCE OF COSMIC DUST IN THE UPPER ATMOSPHERE. Link, F. (CNRS, Paris). Planet. Space Sci.; 23: No. 6, 1011-1012(Jun 1975).

The activity of Librids on 4 April 1973 was detected by the rise of the twilight luminosity. The ratio of circumzenithal luminosity in the anti-solar to solar azimuth also increases in the presence of cosmic dust in the upper atmosphere. (auth)

10220 LOWER F-REGION BARIUM RELEASE EXPERIMENTS AT A SUB-AURORAL LOCATION. Baxter, A. J. (United Kingdom Atomic Energy Authority, Aldermaston, Eng.). Planet. Space Sci.; 23: No. 6, 973-983(Jun 1975).

A series of barium release experiments have been conducted at altitudes near 160 km from the R. A. Hebrides Range (L = 3.5). A predominantly westward neutral drift has been observed for all releases conducted during evening twilight. The development of the ionized clouds are characterized, in this situation, by a lack of separation from the neutral release material and by a rapid onset of the formation of structure. The implications of these features are discussed and numerical modelling used to describe the steepening and striation onset in the ion clouds. It is concluded that the most likely striation sizes are those which are of sufficiently small scale to be electrostatically isolated from other regions of the ionosphere but not so small as to be diffusively dispersed. (auth)

10221 INTERPLANETARY MAGNETIC FIELD POLARITY AND LOW-LATITUDE GEOMAGNETIC FIELD. Bhargave, B. N.; Rangarajan, G. K. (Indian Inst. of Geomagnetism, Bombay). Planet. Space Sci.; 23: No. 6, 929-933(Jun 1975).

The relationship between the low latitude magnetic field and the polarity of the interplanetary magnetic field, inferred by Svalgaard for a period of about 4 solar cycles, is derived and discussed for low and high solar activity conditions. The field reacts differently during the passage of A (away) and C (toward) sectors and, during the passage of sector boundary, the response is substantially different depending upon the nature of the change, i.e. A to C or C to A; a change of sector from A to C is found to be associated with a large depression in the field. It is also observed that the night-time field in low latitudes is best correlated with the AC index and that the correlation, observed throughout the period of 1929 to 1957, breaks down after 1962. The results computed from Alibag observations are confirmed by an examination of the data from Hermanus and San Juan. (auth)

10222 SUPERSONIC PLASMA FLOW BETWEEN HIGH LATITUDE CONJUGATE IONOSPHERES. Roesler, G. (Max-Planck-Institut fuer Physik und Astrophysik, Garching/Muenchen (F.R. Germany). Inst. fuer Extraterrestrische Physik). J. Geophys.; 41: No. 4, 413-439(Jun 1975).

The polar wind problem has been investigated for closed field lines in situations where one of the two conjugate ionospheric regions is fully illuminated by the sun and the other darkness (solstices at high latitudes). A supersonic flow between hemispheres is possible; the magnetospheric part of this flow must be symmetric with respect to the equator. The daytime fluxes are proportional to the neutral hydrogen density. Fluxes of the order of 10^9 cm^{-2} sec^{-1} are only possible with density considerably higher than given by CIRA models. For stationary solutions higher flow speeds are needed on the dark side than provided from the illuminated side. It is concluded that shock waves with upward velocities of about 5 km/sec would form above the dark ionosphere. This implies a reduction by a factor of 3 to 5 of the plasma influx into the dark hemisphere, whereby F-layer densities of only up to 2×10^4 cm^{-3} can be maintained. (auth)

10223 TRANSMISSION OF ELECTRIC FIELDS AND PHOTOELECTRON FLUXES BETWEEN CONJUGATE IONOSPHERIC F2-REGIONS. Petelski, E. F. (Dornier-System G.m.b.H., Friedrichshafen (F. R. Germany). Entwicklungsabteilung Raumfahrt). J. Geophys.; 41: No. 3, 243-263(May 1975).

12 figs.; 2 tabs.; 30 refs. Shortened version of a thesis.

The dynamic behavior of the ionospheric F2-layer requires considerable vertical transport of ionization. Possible causes of such transport are ambipolar diffusion, neutral air winds and electric fields. Here mid-latitude electric fields are investigated. Real height variations of the F2-layer indicate that the phases and amplitudes of these fields are similar at well conjugate points and that the field strengths can become unexpectedly high. It is further shown that photoelectrons can migrate between the two hemispheres along the geomagnetic field lines. (auth)

10224 EFFECT OF LOW ENERGETIC ELECTRONS IN THE POLAR IONOSPHERE. Hartmann, G. K. (Max-Planck-Institut fuer Aeronomie, Lindau/Harz (F. R. Germany)). J. Geophys.; 41: No. 3, 233-242(May 1975).

4 figs.; 19 refs.

Measurements of the dispersive Doppler effect of the 150/400 MHz signals of the five orbiting US-NNSS satellites provide with good accuracy, the integral electron content I of the ionosphere as a function of geographic latitude ϕ. The research reported here was based on I (ϕ)-curves calculated at Oulu, Finland and such from Lindau/Harz. The behavior of the main trough in I is studied. Data from winter 1972 were compared with relevant F_0F2 data measured at Freiburg, FRG; Lindau, FRG; Juliusruh, GDR; Uppsala and Lycksele, Sweden; and Sodankylae, Finland. On November 11, 1971, an effect was observable which was not reported yet. The electron content I showed in the latitude range 60^0 to 65^0 N in the time interval from 1,600 UT to 1,700 UT a strong increase towards north. The relevant F_0F2 curve at 1,700 UT showed a reverse behavior. At earliest one hour later the F_0F2 showed again a trend similar to that of I. If the increase of I was caused by precipitating low energetic particles the above mentioned time delay of at least one hour leads to the conclusion that the increase was caused by precipitating electrons with energies less than 100 eV. (auth)

Magnetospheric Phenomena

Refer also to abstracts 10115 and 10188.

10225 ROLE OF THE MAGNETOSPHERE IN SATELLITE AND RADIOSTAR SCINTILLATION. Booker, H. G. (Univ. of California, La Jolla, San Diego). J. Atmos. Terr. Phys.; 37: No. 8, 1089-1098(Aug 1975).

A theory is developed to account for the scintillation phenomenon observed in equatorial regions when using communications satellites in the SHF band. The same theory is also used qualitatively to explain strong scintillations in the VHF band. Instead of confining irregularities to a narrow interval of height in the F-region and assuming that they are strong, the alternative hypothesis is used that the irregularities are weak but extend from the F-region upwards into the magnetosphere. It is suggested that the irregularities are field-aligned and extend at least up to an L-shell of 1.3 and possibly up to 2 or more. (auth)

10226 LOCATING THE Pc 1 GENERATION REGION BY A STATISTICAL ANALYSIS OF GROUND BASED OBSERVATIONS. Roth, B.; Orr, D. (Univ. of York, Eng.). Planet. Space Sci.; 23: No. 6, 993-1002(Jun 1975).

A statistical study using data from four geomagnetic recording stations with McIlwain parameters from L = 2.5 to 6.6 suggests that the general source location of Pc 1 micropulsations lies close to the plasmapause. For each station a contour plot of the number of Pc 1 events occurring at specific K_p and LT intervals is constructed and a curve representing the plasmapause being overhead at this station is superimposed. The relative positions of the plasmapause curve and the contour maxima are taken to indicate the position of the Pc 1 source location. (auth)

10227 THE NATURE OF THE LOW-FREQUENCY ELECTROMAGNETIC RADIATION IN THE POLAR CAP. Golikov, Yu.V.; Pustovalov, Yu.V.; Romanov, A.B.; Silin, V.P.; Tikhonchuk, V.T.; Troitskaya, V.A. (P. N. Lebedev Physics Institute, USSR Academy of Sciences). JETP Lett. 22: No. 1, 1-2 (5 July 1975).

A region of increased electromagnetic radiation was observed in the earth's polar cap. It is shown that this radiation is generated by streams of low-energy electrons. The theoretically calculated level and spectral distribution of the turbulent noise agrees with the results of land-based measurements and of measurements with the aid of satellites. (auth)

10228 PROTON FLUXES UPSTREAM FROM THE EARTH'S BOW SHOCK. Anderson, K. A.; Lin, R. P.; Meng, C. I. (Univ. of California, Berkeley). pp 225-227 of Correlated Interplanetary and Magnetospheric Observations. Page, D. E. (ed.) Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From 7th ESLAB conference on correlated interplanetary and magnetospheric observations; Saulgau, Ger. (22 May 1973).

10229 MEASUREMENTS OF SOLAR PROTONS IN THE NEAR EARTH MAGNETOTAIL. Domingo, V.; Page, D. E.; Wenzel, K. P. (ESRO, Noordwijk, Netherlands). pp 507-516 of Correlated Interplanetary and Magnetospheric Observations. Page, D. E. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From 7th ESLAB conference on correlated interplanetary and magnetospheric observations; Saulgau, Ger. (22 May 1973).

Preliminary results are presented of the measurement of protons in the high latitude magnetosphere using the HEOS2 spin stabilized spacecraft. Data were obtained from the front solid state detector in anticoincidence with the back detector and the scintillator. The detector was operated on an angular mode while the channel measured protons of 1 to 9 MeV and electrons of about 0.4 to 0.6 MeV. Results indicated that the anisotropy measurement in the near earth magnetotail for protons of about 1 MeV showed a reasonable gradient of fluxes present in it. It is possible to use this measurement to map the penetration of protons into the polar cap. (IAA)

10230 CORRELATED INTERPLANETARY AND MAGNETOSPHERIC OBSERVATIONS: PROCEEDINGS OF THE SEVENTH ESLAB SYMPOSIUM, SAULGAU, WEST GERMANY, MAY 22-25, 1973. Page, D. E. (ed.). Astrophysics and Space Science Library. Vol. 42. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974). 675p. $78.62.

The investigations reported are related to the response of the magnetosphere to changes in the interplanetary medium, the nature of magnetospheric boundaries, magnetospheric plasma flow and electric fields, and solar particle propagation in the interplanetary medium. Solar particle entry to the earth is considered along with the August 1972 solar events. Future study topics are also discussed, giving attention to solar activity and the weather, the Jovian radiation belt, and the design and development of a space laboratory to conduct magnetospheric and plasma research. (IAA)

PHYSICS (ATOMIC AND MOLECULAR)

10231 COMPOSITE GAUGE FIELDS AND DYNAMICAL SYMMETRY BREAKING. Budini, P. (International Centre for Theoretical Physics, Trieste, Italy); Furlan, P. Nuovo Cim., A; 30A: No. 1, 63-80(1 Nov 1975).

Considering biquadratic Lagrangians of the Fermi type as the low energy limit of a renormalizable Yang-Mills gauge theory, the possibility of composite-state formation is studied. It is shown that the composite states, under certain nonrestrictive conditions, bear the same quantum numbers as the underlying boson gauge fields. If the underlying gauge theory includes "charge" operators which give rise to parity-conserving currents, then these give origin in the biquadratic effective Lagrangians to terms of the same form as those adopted by Nambu and Jona-Lasinio in their work on spontaneous symmetry breaking, giving thus origin to mass terms for the spinor multiplets. Further consequences, such as existence of pseudoscalar boson and vacuum degeneracy, can be drawn as in the above-mentioned work. As an example of application of this approach a Konopinski-Mahmoud-type model of leptons is considered. It is shown that by the proposed mechanism the lepton masses could be spontaneously generated including μ-e asymmetry, but in order to obtain massless neutrinos one must start from a 4-dimensional instead of a 3-dimensional fermion multiplet. It is shown that in this model the Fermi constant should obey a dynamical integral equation which, under a simplifying hypothesis, can be explicitly given. (auth)

Beams and Their Reactions

Refer also to abstracts 10295 and 11077–11079.

10232 (CONF-750965-1) DECHANNELING MEASUREMENTS OF DEFECT DEPTH PROFILES AND EFFECTIVE CROSS-CHANNEL DISTRIBUTION OF MISALIGNED ATOMS IN ION IRRADIATED GOLD. Pronko, P. P. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 27p. Dep. NTIS $4.50.

From international conference on atomic collisions in solids; Amsterdam, Netherlands (22 Sep 1975).

Defect depth profiles for self ion and He^+ irradiated gold are obtained from single and multiple scatter dechanneling analysis in single crystal gold films. Quantitative defect densities are obtained through use of atomic scattering cross sections. Integral damage profiles are extracted from the dechanneling spectra and subsequently differentiated to yield the volume concentration of defects as a function of depth. Results from the self ion irradiations suggest that incident ions produce defect distributions across depths much greater than predicted by random stopping theory. This is in agreement with TEM observations of others. Comparison of the experimental profiles is made with theoretical vacancy distributions predicted by defect diffusion in a radiation environment. Similarities are observed for the low fluence irradiations suggesting that profile characteristics may be controlled by rapid migration and loss of interstitials to the film surfaces during irradiation. Information on the across-channel distribution of misaligned atoms in the damaged films is obtained with the steady increase of transverse energy model applied to the dechanneling spectra. A predominance of slight misalignment is observed with no contribution to dechanneling coming from atoms displaced significantly close to the center of the channels. This is in keeping with what is expected for crystal distortions caused by the strain fields associated with vacancy cluster defects. (auth)

10233 (CONF-750975-7) EXTREME ULTRAVIOLET SPECTRA OF HIGHLY STRIPPED SILICON IONS. Griffin, P. M.; Pegg, D. J.; Selling, I. A.; Jones, K. W.; Pisano, D. J.; Kruse, T. H.; Bashkin, S. (Oak Ridge National Lab., Tenn. (USA)). 1975. 9p. Dep. NTIS $4.50.

From fourth international conference on beam-foil spectroscopy; Gatlinburg, Tennessee, USA (15 Sep 1975).

A study of foil-excited spectra in the wavelength range 107-374 Angstroms from highly stripped Si ions is reported. Many of the lines that have been identified are associated with DELTA n equals O transitions in Si VI–Si XI of the type 2s2p/sup k/–2s2p/sup k + 1/ or 2s2p/sup k/–2p/sup k + 1/. 2 figures, 1 table (GHT)

10234 (JINR-R9-7339, pp 254-263) ANALYSIS OF STRUCTURE AND ELEMENTS OF A SUBSTANCE BY MEANS OF ACCELERATED CHARGED PARTICLES. Gabanets, J. (Ustav Jaderne Fyziky, Rez, Czech.). 1973. (In Russian).

From 3rd symposium on the isochronous cyclotron U-120M and its uses for studies on nuclear physics; Ceske Budejovice, Czechoslovakia (14 May 1973). (Joint Inst. for Nuclear Research, Dubna (USSR)).

The results reported of work on the U-120M cyclotron of the Nuclear Physics Institute on analysis of elements and structure of substances, namely analysis of organic substances by the elastic scattering of alpha particles, activation analysis with charged particles, and channeling of charged particles by crystals. (INIS)

10235 (UCRL-77310) MEASUREMENT OF X-RAYS EMITTED FROM PROJECTILES MOVING IN SOLID TARGETS. Fortner, R. J.; Matthews, D. L.; Feldman, L. C.; Garcia, J. D.; Oona, H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1975. 10p. (CONF-750975-5). Dep. NTIS $4.50.

From 4th international conference on beam-foil spectroscopy; Gatlinburg, Tennessee, USA (15 Sep 1975).

The results of three separate experiments all dealing with the production of x-rays in projectiles moving in solids are discussed. The first experiment deals with the measurement of line widths of x-rays emitted from projectiles moving in solid targets. The effect of collisional broadening of x-rays is found to dominate the line widths giving greater than an order of magnitude increase in the measured line widths. The second experiment studies "solid target effects" in producing non-binomial distributions of characteristic K x-ray spectra in heavy ion-atom collisions. The third experiment studies aluminum K x-ray production in Ar^+ yields Al collisions in very thin aluminum foils as a function of foil thickness. Parameterization of the observed non-linear dependence enables the lifetime of the argon 2p vacancy and total ionization cross sections for the argon L-shell in Ar yields Al collisions to be measured. (auth)

10236 TECHNIQUES IN POLARIZATION PHYSICS. Clausnitzer, G. (Giessen Univ. (F. R. Germany). Strahlenzentrum). pp 1-37 of Polarization Nuclear Physics. Proceedings. Fick, D. (ed.) (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Berlin; Springer (1974).

From meeting on polarization physics; Ebermannstadt, F. R. Germany (1 Oct 1973). 14 figs.; 3 tabs.; 110 refs.

The methods of producing a polarized beam in an ion source are described, as well as those necessary to create a polarized target. (GE)

10237 ELECTROSTATIC SELF-FOCUSING PROCESS IN ELECTRON STREAMS. McCorkle, R. A. (IBM Watson Research Center, Yorktown Heights, NY). J. Phys., A (London); 8: No. 6, 987-996(Jun 1975).

Properties of electrostatically self-focused electron streams are calculated from stream injection parameters. The unneutralized ion density within the stream can be nearly an order of magnitude greater than that of stream particles alone. This effect is due to ionization by stream particles and collective behaviour of the stream and ambient plasma. Cold, uniform streams can occur only where stream linear density is sufficiently high. In certain cases ion cluster and molecular ion formation give rise to tight focusing. Periodic self-focusing provides axial electric fields which can resonantly drive stream particle oscillations and which can be used for acceleration of ambient ions. (auth)

10238 OPTICAL AND HYDRODYNAMICAL APPROACHES TO CHARGED PARTICLE BEAMS. Lawson, J. D. Plasma Phys.; 17: No. 7-8, 567-582(Jul 1975).

The optical paraxial ray equation for charged particles, including the effects of self fields, is discussed in both the laboratory and rotating Larmor frames. The corresponding beam envelope equation is derived, in the first instance for laminar flow but later for some non-laminar distributions. The equivalence between optical and hydrodynamical viewpoints is discussed in some detail, and the relation between pressure and emittance is explored. Finally, some of the characteristics of longitudinal energy spread in the beam are investigated. (auth)

10239 MOLECULAR EFFECTS IN BEAM-FOIL SPECTROSCOPY. Bickel, W.S. (Research Institute for Physics, Stockholm 50, Sweden). Phys. Rev. A 12: No. 5, 1801-1807 (Nov 1975).

The character of the ionic beam downstream from the foil in a beam-foil experiment depends on whether the incident particle entering the foil is atomic or molecular. In this paper it is demonstrated how incident molecules affect charge-state distributions, beam-particle scattering, charge exchange, excitation functions, mean lives and transition probabilities, alignment, and linear straggling after the foil. The possibility of exploiting certain molecular effects for further study is also discussed. (auth)

10240 SLOWING-DOWN TIME OF ENERGETIC IONS IN SOLIDS. Oen, O.S.; Robinson, M.T. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). J. Appl. Phys. 46: No. 12, 5069-5071 (Dec 1975).

The average time required for an energetic ion or primary knock-on atom to slow down in a structureless solid has been calculated using a Thomas-Fermi interaction potential and electronic stopping power which is proportional to the velocity. The relevance of this time to radiation damage production is discussed. (auth)

10241 GLOW DISCHARGE SOURCE OF H^- IONS. Rhodes II, R.A.; Block, W.F.; Wallace, B.G. (Ionics Project, Eckerd College, St. Petersburg, Florida 33733). Rev. Sci. Instrum. 46: No. 12, 1710-1710 (Dec 1975).

A simple glow discharge source of H^- ions has been built that has the advantages but not the disadvantages of the hot cathode type. The maximum stable current produced by this source was 8.8×10^{-9} A. The source was also found to produce stable currents of H^+, H_2^+, and H_3^+ at the same order of magnitude as that of the H^- ions. (auth)

10242 VOLTAGE FOCUSING OF A TELEFOCUS ELECTRON GUN. Rasmussen, V.K. (Bartol Research Foundation of The Franklin Institute, Swarthmore, Pennsylvania 19081). Rev. Sci. Instrum. 46: No. 12, 1711-1712 (Dec 1975).

An electron gun based on Steigerwald's design is described. It is of particular interest in that large changes in the cathode to focus distance can be effected by changing the voltage on one electrode, which operates at moderate voltages with respect to the cathode. (auth)

10243 SOURCES FOR SEEDED BEAMS OF K AND KF. Lübbert, A.; Rotzoll, G.; Viard, R.; Schügerl, K. (Institut für Technische Chemie, Technische Universität Hannover, 3000 Hannover, Callinstrasse 46, West Germany). Rev. Sci. Instrum. 46: No. 12, 1656-1658 (Dec 1975).

Double chamber ovens having an additional gas feed line which allows generation of seeded K and KF beams with a variety of gases are described. The seed species partial pressure is kept at ≤ 1 Torr, and the total pressure is varied up to 800 Torr. The beams are skimmed with heated nickel skimmers. The velocity and speed ratio of the beams and their dependence on seeding gas identity and pressure are presented. (auth)

10244 RHENIUM BONDED LaB_6 ELECTRON SOURCE. Ramachandran, K.N. (Semco Instruments, 1339 Baseline Road, Ottawa, Ontario K2C 0A7, Canada). Rev. Sci. Instrum. 46: No. 12, 1662-1663 (Dec 1975).

A new technique has been developed to bond LaB_6 to rhenium under a high temperature arc. Such a bond exhibits remarkable stability even when reheated to the emission temperatures above 1500°C, and thus presents a convenient method for making compact, high intensity electron sources for SEM and other applications. (auth)

10245 ENERGY SPREADING AND ANGULAR DISTRIBUTION OF A BEAM OF ELECTRONS IN MOLECULAR HYDROGEN. Heaps, M.G.; Green, A.E.S. (University of Florida, Gainesville, Florida 32611). J. Appl. Phys. 46: No. 11, 4718-4725 (Nov 1975).

A Monte Carlo approach is used to obtain the energy spreading and angular distribution of initially monoenergetic and monodirectional beams of electron incident on a gas of molecular hydrogen. Several beams of primary electrons and the resultant secondaries are degraded in a step-by-step procedure which utilizes a detailed set of cross sections, together with reasonable approximations for the creation of secondary electrons. Particular attention is paid to the initial angular distribution of secondary electrons. An analytic function which characterizes current experimental differential cross-section data is used to provide realistic inputs into our calculations. The results for energy distribution as a function of distance and angular distribution at selected energies and distances are illustrated. (auth)

10246 SECOND-ORDER TREATMENT OF COMBINED EFFECTS OF SPACE-CHARGE AND EXTERNAL FIELDS ON PLANE-SYMMETRIC ZERO-EMITTANCE BEAMS OF CHARGED PARTICLES. Bosi, G. (Département de Physique, Université de Moncton, Moncton, New Brunswick, Canada). J. Appl. Phys. 46: No. 11, 4689-4696 (Nov 1975).

An earlier first-order treatment of the space-charge spread of zero-emittance charged particle beams under the influence of plane-symmetric external fields is revised and extended to include second-order effects. Elliptic and rectangular cross-section beams are investiged and conditions for parallel beam transport are carried out. (auth)

10247 TEMPERATURE DEPENDENCE OF TRANSMISSION PROTON CHANNELING IN Ag. Berliner, R.; Koehler, J.S. (Department of Physics and Materials Research Laboratory, University of Illinois, Urbana, Illinois 61801). Phys. Rev. B 12: No. 9, 3559-3574 (1 Nov 1975).

Channeling measurements have been made on four Ag single crystals at $T=300$ K, $T=90$ K, and $T=20$ K in the transmission configuration with 1-MeV protons. Effects due to temperature, crystal thickness, and crystal perfection were investigated through the use of large-angle (45°) Rutherford scattering and small-angle transmitted intensity and energy measurements. The majority of the measurements were for the $<100>$ axis but some measurements were also performed on the $<110>$ axis. The results for the temperature dependence of $\psi_{1/2}(<100>)$ (the angular half-width) and the channeling minimum yield agree well with the theoretical expectations and show effects due to crystal thickness and imperfections. The transmission measurements of the channeled-particle stopping power provide a spread in the values for β (the ratio of the energy loss for channeled particles to that for random particles) from 0.43 to 0.75 primarily owing to variations in specimen perfection. A study of the exit-particle energy distributions for various crystal positions near the $<100>$ axis correlates with the transmitted particle intensity distribution data and is in qualitative agreement with the E_1 diffusion model of dechanneling. (auth)

10248 ELASTIC-SCATTERING THEORY OF FAST POSITIVELY CHARGED PARTICLES BY THE CRYSTALLOGRAPHIC PLANE. Kalashnikov, N. P. (Moscow Physical Engineering Inst.). Nuovo Cim.; 29B: No. 1, 1-8(11 Sep 1975).

The elastic scattering of the fast positively charged particles in a single crystal is investigated. The angular-distribution function of the fast positively charged particles scattered by the crystallographic plane is studied when the momentum of the incident particles is parallel to the crystallographic plane. The dependence of the total cross section on the thickness of a single crystal is examined. (auth)

10249 ELASTIC SCATTERING OF FAST POSITIVELY CHARGED PARTICLES BY THE ATOMIC ROW IN A SINGLE CRYSTAL. Kalashnikov, N. P.; Strikhanov, M. N. (Moscow Physical Engineering Inst.). Nuovo Cim.; 29B: No. 1, 9-17 (11 Sep 1975).

The theory of coherent elastic scattering of fast positively charged particles in a single crystal is presented. The interaction of fast positively charged particles with the crystallographic atomic row is investigated in detail when the incident-particle momentum is parallel to the crystallographic axis. The differential and total scattering cross-sections are obtained. The dependence of the total scattering cross-section on the length of the atomic string is examined. (auth)

10250 PLEA FOR CHARGE INJECTION FOR ION EXTRACTION. Majumdar, N. K. (Saha Inst. of Nuclear Physics, Calcutta). Nuovo Cim.; 29B: No. 1, 178-188(11 Sep 1975).

A gas discharge system, as is used for ion sources, is specified by the physical quantities, pressure, applied voltage, geometry and material properties. The potential pattern under any such conditions is ultimately responsible for the ion extraction. The extraction space is the sheath region, occasioned by sharp voltage drops, and the plasma cap is the region held by a potential barrier. The presence and pattern of free charges, under given conditions, account for the plasma sheath disposition that exists over the extraction canal of an ion source (magnetic or nonmagnetic types). By solving a suitably arranged Poisson equation, explicit expressions for the potentials can be found under appropriate conditions. Theoretically, charge injection in this space could profoundly influence this plasma sheath formation for a more favorable potential form and ion outflow; and can set in oscillations of the plasma boundary that would trigger regenerative extraction possibilities. (auth)

10251 THE USE OF DEEPLY IMPLANTED TARGETS IN NUCLEAR SPECTROSCOPY. Grawe, H.; Heidinger, F.; Holzer, K.; Kaendler, K. (Freiburg Univ. (F. R. Germany). Fakultaet fuer Physik). Nucl. Instrum. Methods; 127: No. 2, 311-316(1 Aug 1975).

Noble gas targets for DSA experiments were prepared by implantation at energies of 150-200 keV/amu. The distribution of the implanted atoms was measured in an α-backscattering experiment. (NL)

10252 EXPERIMENTS ON THE FORMATION AND DETECTION OF He^- IONS USING A HIGH SENSITIVITY DEVICE. Muller, C.; Lorentz, B.; Remy, M. (Nancy-1 Univ., 54 (France). Lab. de Physique des Milieux Ionises). Int. J. Mass Spectrom. Ion Phys.; 18: No. 1, 33-42(Sep 1975).

A device is described which is essentially made of a duoplasmatron ion source, modified to permit direct extraction of negative ions and of a magnetic sector for the mass or energy analysis of the beam. This device has been tested with He^- ions and the influence of some physical parameters on the process of formation of these ions studied. Original features of the device, which make it suitable for the extraction and detection of ions of low abundance and weakly bound ions, are described in detail. (NL)

10253 THE DISCRIMINATION OF ISOBARIC NUCLEAR REACTION PRODUCTS WITH THE HELP OF POSITIVE AND NEGATIVE SURFACE IONIZATION. Mueller, R.; Wassmuth, H.-W. (Marburg Univ. (F. R. Germany). Fachbereich Physik). Nucl. Instrum. Methods; 127: No. 2, 225-236(1 Aug 1975). (In German)

The possibility of utilizing the phenomena of positive and of negative surface ionization in connection with a mass separator for a rapid discrimination or even a selective separation of isobar nuclides of certain elements is discussed and supported by by experimental results. Whereas on a clean metal surface (e.g. tungsten only alkali elements are efficiently ionized by positive surface ionization, certain other elements may also be manipulated to have high ionization-efficiency values by increasing the work function of the substrate with a regulated coverage of electronegative ad-particles (e.g. oxygen). A preselection of such elements is thus possible if under the same surface conditions isobar nuclides of the neighboring elements have very small values of the ionization efficiency. In the case of neighboring elements having almost equal values of the ionization energy, other surface effects can often be utilized for an identification of the nuclides: (1) the desorption of some elements in the form of oxides under special conditions of temperature and oxygen pressure, and (2) the high desorption energy of certain elements which practically do not desorb at lower temperatures. Thus, apart from the nuclides of the alkalis, those of a variety of other elements (e.g. earth alkalis and elements of the IIIb group) may be identified with the help of positive surface ionization. The negative surface ionization can be used for a selective separation of the elements of the halogen group. In this case high values of the ionization efficiency can be obtained only at low values of the work function. Preliminary results which have been obtained by a deposition of electropositive adlayers on a tungsten surface are reported. (NL)

10254 CAPTURE AND RELEASE OF HELIUM DURING BOMBARDMENT OF NIOBIUM WITH He^+ IONS. Pisarev, A. A.; Telkovski, V. G. At. Energ. (USSR); 38: No. 3, 152-155(Mar 1975).

The capture of He^+ ions bombarding a niobium target with an energy of 15-keV is investigated in this work. The temperature during irradiation was varied from 290 to 1800°K. The dependences of coefficients of capture and gas emission, number of absorbed particles on temperature of sample during bombardment and irradiation dose were obtained and are explained on the basis of analysis of gas emission spectra obtained during heating after capture. The captured ions are not retained in the metal, but are completely released into vacuum at temperatures above 1500°K. The main process leading to gas emission at high irradiation doses is the bursting of gas-filled sub-surface blisters. At very high temperatures (1500°K), the process of fast diffusion of helium atoms to the surface of the metal may preclude blistering. 5 figures, 21 references (auth)

10255 CHARACTERISTIC ENERGY LOSSES OF ELECTRONS SCATTERED FROM A MOLYBDENUM TARGET. Arifov, U. A.; Aliev, A. A.; Shadikhodzhaev, I. S. (Inst. of Electronics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 6, 45-48(1974). (In Russian).

A study is made of the characteristic energy losses of electrons scattered from the (100) and (110) planes of the Mo crystal. Detailed consideration is given to changes in intensity (height) of characteristic loss peaks as a function of energy and incident angle of the bombarding electrons. By means of an experimental unit and a technique of investigating the energy spectra of scattered electrons it is possible to follow dynamically changes in the characteristic loss peaks as a function of the above parameters on an oscillograph screen. (SJR)

Atomic and Molecular Properties

Refer also to abstracts 8886, 8887, 10008, 10169, 10233, 10330, and 10339.

10256 HYPERFINE INTERACTION AND POLARIZATION. Matthias, E. (Freie Univ. Berlin (F. R. Germany). Inst. fuer Atom- und Festkoerperphysik). pp 114-160 of Polarization Nuclear Physics. Proceedings. Fick, D. (ed.). (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Berlin; Springer (1974).

From meeting on polarization physics; Ebermannstadt, F. R. Germany (1 Oct 1973). 21 figs.; 90 refs.

A report is given on the measuring methods to investigate the hyperfine structures in gases, liquids and metals. The polarization or alignment production methods are also mentioned. (GE)

10257 PHOTOELECTRIC ATOMIC ABSORPTION CROSS SECTIONS FOR ELEMENTS Z = 6 TO 54 IN THE MEDIUM ENERGY X-RAY RANGE (5 TO 25 keV). I. Hildebrandt, G.; Stephenson, J. D.; Wagenfeld, H. (Max-Planck-Gesellschaft zur Foerderung der Wissenschaften e.V., Berlin (F. R. Germany). Fritz-Haber-Institut). Z. Naturforsch.; 30A; No. 6/7, 697-707(Jun 1975).

2 figs.; 3 tabs.; 8 refs.

Photoelectric atomic absorption cross sections have been calculated by means of hydrogen-like eigenfunctions for the atomic K, L, M, and N sub-shells of the elements Z = 6 to 54, using revised screening constants and an extension of the theory. The absorption cross sections have been further separated into dipole and quadrupole components so that the numerical data can also be applied to the Borrmann effect. (auth)

10258 *Ab initio* VALENCE BOND CALCULATIONS OF THE POTENTIAL ENERGY SURFACE FOR $H+H_2$. Norbeck, J.M.; Certain, P.R. (Theoretical Chemistry Institute and Department of Chemistry, University of Wisconsin, Madison, Wisconsin 53706). J. Chem. Phys. 63: No. 10, 4127-4132 (15 Nov 1975).

Valence bond calculations of the potential energy surface of $H+H_2$ have been done. In all the calculations the hydrogen molecule bond length was kept at 1.4 a_0. The isotropic potential $V_0(r)$ and the leading anisotropic potential $V_2(R)$ were obtained. Our calculated V_0 is in good agreement with the experimentally determined V_0 reported by Gengenbach, Hahn, and Toennies. Our calculations predict that the triangular arrangement of H_2+H is favored over the linear configuration at long distances of R with alignment to the linear geometry at approximately 3.1 a_0. A population analysis of our wavefunction is also presented. (auth)

10259 EXPERIMENTAL INVESTIGATION OF SMALL He CLUSTERS. van Deursen, A.P.J.; Reuss, J. (Katholieke Universiteit, Fysisch Laboratorium, Toernooiveld, The Netherlands). J. Chem. Phys. 63: No. 10, 4559-4560 (15 Nov 1975).

The question of the existence of a bound state for He_2 has been investigated by observing ionized He_n^+ clusters produced in a low temperature molecular beam. The results agree with the prediction that there is no bound state for He_2. (AIP)

10260 NONADIABATIC CORRECTIONS TO THE POLARIZABILITY OF THE HYDROGEN MOLECULE. Karl, G.; Poll, J.D. (Physics Department, University of Guelph, Guelph, Ontario N1G 2W1, Canada). Phys. Rev. A 12: No. 5, 2239-2240 (Nov 1975).

This note draws attention to a small correction to the calculated value of the polarizability of the hydrogen molecule, arising from the use of the Born-Oppenheimer approximation. After including the correction, the discrepancy between theory and experiment is identical in the two cases of H_2 and D_2. (auth)

10261 CALCULATION OF THE MEAN IONIZATION POTENTIALS OF THE ELEMENTS FOR STOPPING-POWER COMPUTATIONS. Mukherji, S. (Department of Chemistry, Indian Institute of Technology, Kanpur-16, U.P., India). Phys. Rev. B 12: No. 9, 3530-3532 (1 Nov 1975).

The mean ionization potential $\bar{I}$ of an element of atomic number Z has been calculated on the basis that the velocity distribution among the orbital electrons of an atom is given by $n(u_e) = f(Z)\, u_e/v_0$, where $n(u_e)$ is the number of orbital electrons with velocity less than u_e, v_0 is given by $e^2/\hbar$, and $f(Z)$ assumes the values $0.28Z^{2/3}$ for $Z \leq 45.5$ and $Z^{1/3}$ for $Z \geq 45.5$. The calculated values for the case of light elements are in fair agreement with the corresponding experimental values of the mean excitation potentials, but for the case of the heavier elements these are appreciably lower than the experimental values. (auth)

10262 GENERALIZED X—RAY SCATTERING FACTORS IN DIATOMIC MOLECULES. Stewart, R.F.; Bentley, J. (Department of Chemistry, Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213); Goodman, B. J. Chem. Phys. 63: No. 9, 3786-3793 (1 Nov 1975).

Generalized x-ray scattering factors for atoms (pseudoatoms) in diatomic molecules are determined from a finite multipole expansion of the charge density about each nucleus. The Fourier–Bessel coefficients of the pseudoatom radial density functions are determined by a least squares fit to the molecular form factor. All molecular one-center averages of the form $\langle g(r_a)\, P_j(\cos\theta_a) \rangle$ are correctly given by the pseudoatom superposition whenever $j \leq J$, where J is the highest order multipole included in the a pseudoatom, regardless of the highest multipole order K for the b pseudoatom. To illustrate this property, a number of relationships between moments of the molecular charge distribution and of the pseudoatom are given. In addition, a sum rule relating the molecular form factor to the expectation values $\langle r_a^{-(l+1)} P_j(\cos\theta_a) \rangle$ and $\langle r_b^{-(k+1)} P_k(\cos\theta_b) \rangle$ is derived. For H_2 the theoretical, coherent x-ray scattering intensity is reproduced to about 1% for $J=K=1$ and to about 0.1% for $J=K=2$. (auth)

10263 EFFECTS OF PLASMA MICROFIELDS ON RADIATIVE TRANSITIONS FROM ATOMIC LEVELS ABOVE THE IONIZATION THRESHOLD. Davis, J. (Plasma Physics Division, Naval Research Laboratory, Washington, D.C. 20375); Jacobs, V.L. Phys. Rev. A 12: No. 5, 2017-2023 (Nov 1975).

The effects of plasma electric microfields on linelike optical features arising from atomic levels above the ionization threshold are investigated within the framework of the quasistatic and single-frequency dynamical field theories of spectral-line broadening. The $2p^2\,{}^3P \rightarrow 1s2p\,{}^3P$ and $2s2p\,{}^3P \rightarrow 1s2s\,{}^3S$ transitions in helium and heliumlike ions are treated as illustrations. The mixing of the doubly excited levels in the perturbing microfields produces Stark broadening of the emission lines and induces autoionization of the $2p^2\,{}^3P$ level, which, unlike the $2s2p\,{}^3P$ level, is metastable against autoionization in the field-free environment. Determination of the complete Stark-broadening profiles in thermal plasmas is complicated by the need to include the effects of both the (quasistatic) ion and the (dynamical) electron fields. Under nonequilibrium conditions, where electric fields from either electron or ion plasma waves can far exceed nearby particle fields, the calculation and interpretation of the line shapes may be simplified and could provide a diagnostic probe of the wave-field properties. (auth)

10264 MOLECULAR THEORY OF HYPERFINE PRESSURE SHIFTS IN H CAUSED BY Ar AND He BUFFERS. Ray, S. (I. Physikalisches Institut der Universitat Heidelberg, 69 Heidelberg, West Germany). Phys. Rev. A 12: No. 5, 2031-2043 (Nov 1975).

The general applicability of molecular methods for studying hyperfine pressure shifts (HPS) in a hydrogen atom caused by Ar and He noble-gas buffers has been tested thoroughly by carrying out extensive multiconfigurational self-consistent-field (MCSCF) and single-configuration self-consistent-field (SCF) calculations on ArH and HeH diatomic systems. Calculations show that for a He atom, a light noble-gas buffer, single-configuration SCF molecular wave functions are sufficiently good in reproducing the HPS result quantitatively, although qualitatively the weak, long-range polarization features are not described. However, for a heavier noble-gas buffer, such as the Ar atom, the long-range polarization effects are the strong and dominant features in the ArH binary interaction. Because of a lack of a sufficient number of proper functions for describing the long-range polarization features, the single-configuration SCF molecular wave functions do not reproduce the long-range polarization effects adequately. For ArH, therefore, MCSCF molecular wave functions, constructed with a choice of configurations which describe the dominant polarizations, are employed to reproduce the HPS result quantitatively and the long-range features qualitatively. HPS results computed by using MCSCF molecular wave functions are in excellent agreement with the experimental result. (auth)

10265 VIBRATIONAL RELAXATION IN He-H_2 IN THE HIGH ENERGY REGIME. Novak, P.; Wartell, M.A. (Department of Chemistry, Metropolitan State College, Denver, Colorado 80204). J. Chem. Phys. 63: No. 9, 4089-4090 (1 Nov 1975).

Semiclassical calculations of translation–vibration energy transfer in the He–H_2 system have been carried out and compared with recent experimental measurements on the system. (AIP)

10266 SUM RULES AND EXPANSION FORMULA FOR STARK RADIATIVE TRANSITIONS IN THE HYDROGEN ATOM. Herrick, D.R. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. A 12: No. 5, 1949-1953 (Nov 1975).

An expansion formula for Stark effect transition probabilities is derived in terms of field-free (spherical) transition probabilities. Expansion coefficients are squares of Clebsch-Gordan coefficients from the SO(4) = SU(2) × SU(2) description of the hydrogen atom. The method provides new sum rules for Stark transitions which explain regularities in previous calculations. Accurate formulas for average Stark transition probabilities obtain from application of the method to an empirical model for field-free transition probabilities. The approximation permits estimation of Stark lifetimes in the large-n regime. (auth)

10267 WAVELENGTH DEPENDENCE OF THE PHOTOELECTRON ANGULAR DISTRIBUTIONS OF THE RARE GASES. Dehmer, J.L.; Chupka, W.A.; Berkowitz, J.; Jivery, W.T. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. A 12: No. 5, 1966-1973 (Nov 1975).

Photoelectron angular distributions for the valence p shells of the rare gases have been measured up to a photon energy of 40.8 eV (48.4 eV for Ne) using resonance radiation from a hollow-cathode discharge lamp. This work extends the range of existing absolute measurements on Ne, Kr, and Xe. Comparison with Hartree-Fock and RPAE (random-phase approximation with exchange) calculations indicates excellent agreement for Ne. However, the present results, particularly for Xe, add to earlier evidence that data for Ar, Kr, and Xe show systematic deviations from theory, especially at the higher photoelectron kinetic energies. For Kr and Xe, we report asymmetry parameters separately for processes leading to the $^2P_{3/2,1/2}$ spin-orbit states of the residual ion. The Xe results indicate that $\beta_{3/2} - \beta_{1/2}$ is positive for $\lambda \geq 461$ Å, but changes sign in the range $\lambda \sim 350$–400 Å. At 304 Å, $\beta_{3/2} - \beta_{1/2} = -0.30$, which agrees with a recent calculation based on the Dirac-Slater model. (auth)

10268 CALCULATION OF DISSOCIATIVE IONIZATION CROSS SECTIONS OF DIATOMIC MOLECULES. Parikh, M. (Electronics Research Laboratory, University of California, Berkeley, California 94720). Phys. Rev. A 12: No. 5, 1872-1880 (Nov 1975).

A model for calculating the dissociative ionization cross sections of diatomic molecules is developed. The activated state for dissociative ionizations is modeled to occur via the ejection of a bound electron and an excitation of another bound electron. This process is described by successive two-electron scattering in the first Born and the binary-encounter approximations. Comparison of calculated cross sections with available experimental data for five diatomic molecules (H_2, CO, N_2, NO, and O_2) shows good agreement with incident-electron energies above 200 eV. (auth)

10269 SPECTROSCOPIC STUDY OF THE CONSTRICTED ARC DISCHARGE IN HYDROGEN AT LOW PRESSURE. PART 1. Abroyan, M.A.; Demidov, V.I.; Kagan, Yu.M.; Kolokolov, N.B.; Lavrov, B.P. Opt. Spectrosc. (USSR) 39: No. 1, 12-14 (July 1975).

Measurements of the concentration of excited hydrogen atoms in the states with the principal quantum number $k=3$–6 using the spectral lines of the Balmer series, emitted by the plasma of a constricted arc discharge in the 0.02–0.2-Torr pressure range with current up to 0.55 A applying a floating potential of an auxiliary electrode introduced between the cathode and anode, are described. An analysis of the processes of excitation and deactivation of atomic levels with $k=3$–5 is given. A simple model is suggested permitting the computation of concentration of normal atoms and thus the determination of the degree of hydrogen dissociation. The computation of concentration of normal hydrogen atoms is made by using the measurement of the spectral line intensities and of the electron energy distribution function. The effective lifetime of normal atoms in the discharge obtained from their energy balance equation is in agreement with the diffusion time for atoms toward the walls of the discharge space. (auth)

10270 OBSERVATION OF SINGLET–TRIPLET ANTICROSSINGS IN $^4He_2$. Miller, T.A.; Freund, R.S.; Zegarski, B.R. (Bell Laboratories, Murray Hill, New Jersey 07974); Jost, R.; Lombardi, M.; Derouard, J. J. Chem. Phys. 63: No. 9, 4042-4046 (1 Nov 1975).

Anticrossings between excited singlet and triplet levels of the He_2 molecule have been observed. Measurements have been made on anticrossings which take place between the $f\,(3d)\,{}^3\Delta_u$ and $F\,(3d)\,{}^1\Delta_u$ states both in the $v=0$, $N=2,3,4$ and $v=1$, $N=2$ vibrational and rotational levels. Analysis of these results yields a new and more precise value for the excitation energy, T_0, from the $a\,(2s)\,{}^3\Sigma$ to the $A\,(2s)\,{}^1\Sigma$ state. This result, when combined with available optical data, fixes the absolute energy of all He_2 excited states. The present experiment establishes that the steady state populations of the $^3\Delta$ levels are greater than the $^1\Delta$ levels under a variety of excitation conditions. Also, collisional transfer may take place before radiation giving rise to a given anticrossing signal appearing on optical emission lines of several nearby rotational levels. (auth)

10271 RELATION BETWEEN CHARGE AND FORCE PARAMETERS OF CLOSED-SHELL ATOMS AND IONS. Gilbert, T.L.; Simpson, O.C. (Argonne National Laboratory, Argonne, Illinois 60439); Williamson, M.A. J. Chem. Phys. 63: No. 9, 4061-4071 (1 Nov 1975).

Combining rules for parameters which characterize the short-range repulsive forces between closed-shell atoms and ions are used to determine the radius and softness for a number of alkali and halide ions and rare-gas atoms from scattering and spectroscopic data. A corresponding set of charge radii and softnesses are determined from atomic charge densities calculated in both the relativistic and nonrelativistic Hartree–Fock approximations. These characteristic atomic parameters are compared, and it is found that, for species with the same charge belonging to the same column of the periodic table, the relations between charge and force radii and between charge and force softnesses are very nearly linear. The radial distance dependence of the softness is examined, and some areas where further work is needed to follow up this empirical study are indicated.

10272 HIGH RESOLUTION PHOTOIONIZATION STUDY OF ION-PAIR FORMATION IN H_2, HD, AND D_2. Chupka, W.A.; Dehmer, P.M.; Jivery, W.T. (Argonne National Laboratory, Argonne, Illinois 60439). J. Chem. Phys. 63: No. 9, 3929-3944 (1 Nov 1975).

A new photoionization mass spectrometer which is significantly superior to previous instruments in both wavelength resolution and ion intensity is described. It has been used in the study of photon-induced ion-pair formation at 78 °K in para-H_2, ordinary H_2 and D_2 (the ortho-para equilibrium mixtures), and HD in the wavelength region from 718 to 700 Å, at a wavelength resolution (FWHM) of 0.035 Å for para-H_2, 0.07 Å for ordinary H_2 and D_2, and 0.15 Å for HD. The threshold for formation of ion pairs from para-H_2 occurs at $715.753^{+0.046}_{-0.008}$ Å ($17.3223^{+0.0002}_{-0.0011}$ eV) and this value together with the accurately known values of the dissociation energy of H_2 and the ionization potential of atomic hydrogen yields a value of the electron affinity of the hydrogen atom of $0.754_2{}^{+0.0013}_{-0.0004}$ eV in excellent agreement with the theoretical value of 0.75421 eV calculated

by Pekeris. The observed thresholds for ion-pair formation in D_2 and HD are also in excellent agreement with the calculated positions. For para-H_2 the region within 0.5 Å of the threshold has a continuumlike appearance and contains window resonances which are interpreted as predissociating members of a Rydberg series converging to $H^+_2(v=9, N=2)$. The continuum results from closely spaced predissociating Rydberg states converging to $H^+_2(v=9\ N=0)$ which were not resolved in the present experiment. A number of other tentative Rydberg state assignments were made for para-H_2 based on the results of an analysis using multichannel quantum defect theory. No Rydberg state identifications were attempted for the other systems due to the greatly increased complexity of their spectra. For HD which can dissociate to either $H^+ + D^-$ or $H^- + D^+$, the H^-/D^- ratio is ~2 just above threshold and appears to decrease with decreasing wavelength; however, this is due, at least in part, to discrimination by the detection system against the more energetic H^- ions. Some conclusions and inferences regarding the mechanism for predissociation in H_2 and HD are discussed, particularly the possible importance of the $4f\sigma\ ^1\Sigma^+_u$ state. (auth)

10273 DECAY OF ATOMIC SYSTEMS IN A STRONG ELECTRIC FIELD. Negative Ion and Hydrogen Atom. Guschina, N.A.; Nikulin, V. K. (AN SSSR, Leningrad, Fiziko-Tekhnicheskij Inst.). Chem. Phys. (Amsterdam); 10: No. 1, 23-31(Aug 1975).

An exact transcendental equation was obtained determining the energy levels of a particle bound by a short-range force and placed in a uniform electric field. At high field intensities there is a considerable difference between the values of decay probabilities calculated by previous theory and by this one. The results obtained were used to determine the electron binding energy and the polarizability of negative ions by employing experimental data on ion decay during a flight through the field region. Concrete calculations were carried out for the C-ion. The calculation of the resonance energy E_R and the decay probability 2γ of the quasistationary state $n = 5$, $n_1 = 3$, $n_2 = 0$, and $m = 1$ of the hydrogen atom in a uniform electric field was performed by means of the direct integration of the time dependent Schroedinger equation for field intensities ranging from 0.8×10^6V/cm to 1.7×10^6V/cm. The calculated values of E_r perfectly agree with those of the Rayleigh-Schroedinger perturbation energies calculated up to fourth power in the field and differ substantially from the resonance energies obtained earlier by Hirschfelder and Curtiss. The results concerning the rate of spontaneous ionization also differ substantially from the results of Hirschfelder and Curtiss and agree rather well with the results of Bailey, Hiskes and Riviere who used the general WKB method of Rice and Good. (NL)

10274 NUCLEAR COORDINATE DEPENDENCE OF ELECTRONIC TRANSITION MOMENTS IN ORBITALLY FORBIDDEN TRANSITIONS: A NEW INTERPRETATION OF DEUTERIUM ISOTOPE EFFECTS. Kanamaru, N.; Lim, E. C. (Wayne State Univ., Detroit, Mich. (USA). Dept. of Chemistry). Chem. Phys. (Amsterdam); 10: No. 1, 141-155(Aug 1975).

The nuclear coordinate dependence of electronic transition moments has been investigated for the purpose of finding new interpretations of deuterium isotope effects on spectral intensities and radiative decay rates in orbitally forbidden electronic transitions. By using "AO following nuclei" wave functions as the building block for the electronic wavefunction in the adiabatic BO vibronic wavefunctions, the spin-free hamiltonian is diagonalized to generate eigenfunctions and eigenenergies. It is found that the electronic transition moments based on these eigenfunctions show dependences upon the vibrational modes which are not directly involved in vibronic coupling. This leads to interpretation of the deuterium isotope effects in $T_1 \rightarrow S_0$ radiative transitions of aromatic hydrocarbons and $S_0 \rightarrow S_1$ absorption in pyrazine which are not based on the conventional Herzberg-Teller of non-BO coupling. (NL)

10275 COUPLING OF RADIAL AND ANGULAR CORRELATIONS IN TWO-ELECTRON ATOMS. Moiseyev, N.; Katriel, J. (Technion-Israel Inst. of Tech., Haifa). Chem Phys. (Amsterdam); 10: No. 1, 67-72 (Aug 1975).

The nature of interelectronic correlation in the ground and low lying excited states of the helium sequence is investigated. It is demonstrated that as a consequence of the coupling between radial and angular correlation the electrons are actually pulled together rather than pushed apart, in the low nuclear charge end of the isoelectronic sequence. A uniform treatment of correlation effects in both the ground and the excited states is thus shown to be feasible. (NL)

10276 ENERGY OF INTERACTION OF TWO HYDROGEN ATOMS USING CONTRACTED GAUSSIAN TYPE VALENCE-BOND WAVE FUNCTIONS. Olson, M. L.; Konowalow, D. D. (State Univ. of New York, Binghamton). Int. J. Quant. Chem.; 9: No. 6, 1113-1129(Nov 1975).

Valence-bond type wave functions based on contracted Gaussian atomic orbitals afford an adequate description of the potential of the ground $^1SIGMA^+/sub\ g/$ state of H_2 for a wide range of internuclear separations. Semiempirical techniques for scaling the potential curve are evaluated. An efficient method for optimizing nonlinear variables in the wave functions is explored. (auth)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

Refer also to abstracts 9905, 10326, 10371, 10486, and 10502.

10277 (LBL-4608) mu^+SR SPECTROSCOPY: THE POSITIVE MUON AS A MAGNETIC PROBE IN SOLIDS. Brewer, J. H.; Fleming, D. G.; Crowe, K. M.; Johnson, R. F.; Patterson, B. D.; Portis, A. M.; Gygax, F. N.; Schenck, A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1974. Contract W-7405-ENG-48. 22p. (CONF-740633-10). Dep. NTIS $4,50.

From international conference on hyperfine interactions studied in nuclear reactions and decay; Uppsala, Sweden (10 Jun 1974).

Through its asymmetric decay, the positive muon acts as a sensitive detector of the interactions of its spin with the medium in which it comes to rest. Development of the mu^+SR spectroscopy technique is described, and recent applications of the mu^+ as a probe are discussed. Results for hyperfine fields in ferromagnets and impurity states in nonmetals are presented with suggestions for future studies. 6 figures. (auth)

10278 POSITRON DECAY IN POLYMERS: MOLECULAR WEIGHT DEPENDENCE IN POLYSTYRENE. West, D. H. D.; McBrierty, V. J.; Delaney, C. F. G. (Trinity Coll., Dublin (Ireland). Physical Lab.). Appl. Phys.; 7: No. 3, 171-174(Jul 1975).

1 fig.; 1 tab.; 30 refs.

The decay time tau of o-Ps by the electron pickoff process has been measured in polystyrene as a function of molecular weight. For samples below their glass transition temperature tau is essentially independent of M. In the low molecular weight region, $M < 850$, tau increased with decreasing M in line with earlier theoretical predictions. The overall behavior reflects closely the dependence of free volume on M. The effects of molecular motion on tau are examined and it is concluded that the decay time is insensitive to such motions in polystyrene below the melting point, in contrast to what is observed in polytetrafluoroethylene. (auth)

10279 INTENSITY MEASUREMENTS ON Σ-HYPERONIC AND KAONIC ATOMS. Backenstoss, G.; Bunaciu, T.; Egger, J.; Koch, H.; Schwitter, A.; Tauscher, L. (European Organization for Nuclear Research, Geneva (Switzerland); Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Experimentelle Kernphysik; Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Z. Phys., A; 273: No. 2, 137-156 (Jun 1975).

9 figs.; 9 tabs.; 28 refs.

Σ-hyperonic X-ray lines have been observed in 8 elements and their intensities as well as those of the accompanying kaonic X-ray lines have been determined. The Σ-atomic cascade has been found to be similar to those of other exotic atoms. The production of Σ- hyperons per stopped K- has been measured by comparing their X-ray intensities. For the first time the intensity attenuation due to the strong absorptive ΣN interaction could be measured in four cases, and simple optical model calculations have been performed in order to reproduce the data. (auth)

10280 SEARCH FOR MUONIUM ATOM IN COPPER. Grebinnik, V.G.; Gurevich, I.I.; Zhukov, V.A.; Ivanter, I.G.; Manych, A.P.; Nikol'skii, B.A.; Selivanov, V.I.; Suetin, V.A. (I. V. Kurchatov Institute of Atomic Energy). JETP Lett. 22: No. 1, 16-17 (5 July 1975).

A method is proposed for determining the frequency ω_0 of the hyperfine splitting of the muonium atom in a metal. The method is based on measuring the temperature dependence of the μ^+-meson precession-frequency shift due to polarization of the muonium electron. It was found that in copper the frequency is $\omega_0 \lesssim 0.01(\omega_0)_{vac}$ where $(\omega_0)_{vac}$ is the frequency of the hyperfine splitting of the muonium atom in vacuum. (auth)

10281 SUFFICIENT CONDITIONS FOR OBJECTIVE LOCAL THEORIES. Edwards, J. (Simon Fraser Univ., Burnaby, B. C.). Nuovo Cim., 29B: No. 1, 100-104(11 Sep 1975).

It is known that all objective local theories for systems containing two photons must satisfy a generalized Bell inequality. It is shown by specific counter-example that satisfaction of the generalized Bell inequality is not a sufficient condition for the two-photon system formed in the decay of singlet positronium to be described in terms of an objective local theory. (auth)

10282 NATURE OF 10^{-8}S AND 10^{-7}S LIFETIMES IN Al_2O_3. Sen, P.; Sen, C. (State Univ. of New York, Albany). Nuovo Cim.; 29B: No. 1, 124-134(11 Sep 1975).

By using a three-detector lifetime assembly it was shown that the 10^{-8}s component τ_3 in Al_2O_3 of various grain sizes is two photons in nature, contrary to the earlier belief that it refers to three-photon events. The results of the three-detector ortho-positronium lifetime (τ_4) experiment and the three-photon energy spectrum experiment in a Ge(Li) detector are complementary and suggest that bigger grain size powders favor more ortho-positronium formation. The importance of the three-detector lifetime assembly was discussed. (auth)

10283 ANGULAR CORRELATION OF THE TWO-PHOTON POSITRON ANNIHILATION QUANTA IN SILICON DIOXIDE POWDERS. Debowska, M.; Kukulka, J.; Wesolowski, J. (Univ., Wroclaw). Acta Phys. Pol., Ser. A; A48: No. 4, 583-585(Oct 1975).

Angular correlation measurements of the two-photon annihilation quanta were made on aerosols 50, 200 and 300 in vacuum and in air. Using correlation curves obtained by experimental methods, the increase in intensity of the narrow component ΔI_{exp} in air, compared with that in vacuum, was determined. The values of ΔI_{exp} compared with those of ΔI_{theor}, anticipated on the assumption that there occurs o-Ps conversion by oxygen paramagnetic molecules in air, were found in the instance of the aerosols 200 and 300 to be definitely higher than those expected. This effect is not easy to interpret and requires further investigations of the physical and chemical properties of the grain surface. (auth)

10284 POSITRONIUM FORMATION IN POLYACENAPHTYLENES. Goworek, T. (Marie Curie-Sklodowska Univ., Lublin); Rybka, C. Acta Phys. Pol., Ser. A; A48: No. 4, 587-589(Oct 1975).

Positronium formation in the polyacenaphtylene was investigated. It was found that the creation of positronium atoms is, to a large extent, ruled by disordering of the structure rather than by flexibility of the polymer chains. (auth)

10285 EFFECTS OF NONSTATISTICAL HYPERFINE POPULATIONS IN MUON CAPTURE BY POLARIZED NUCLEI. Hambro, L. (CERN, Geneva); Mukhopadhyay, N. C. Lett. Nuovo Cim.; 14: No. 2, 53-59(13 Sep 1975).

The usefulness of muon capture by polarized nuclei as a qualitative and possibly quantitative probe of the difference between the hyperfine capture rates is demonstrated. It is also found that the assumption of statistical hyperfine population in the muon capture by the initial unpolarized lithium-6 target is likely to be reasonable. (JFP)

10286 ELASTIC ELECTRON SCATTERING AND MUONIC ATOMS. Sick, I. (Univ., Basel). AIP (Am. Inst. Phys.). Conf. Proc.; No. 26, 388-407(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The discussion of elastic electron scattering covers (e,e) at large q, linked to it the investigation of isotone pairs, and experiments concerning the higher multipole moments of the ground state density. The corresponding mu-x-ray work is discussed in parallel. (JFP)

10287 MESOATOMIC PROCESSES IN LIGHT ATOMS. Ponomarev, L. I. (Joint Inst. for Nuclear Research, Dubna, USSR). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 563-586(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The experimental and theoretical data which provide evidence for the influence of the chemical structure of matter on the behavior of mesoatomic processes and on the probability of nuclear reactions with mesons are given. The possibilities of practical application of the "mesic chemistry" methods to the analysis of the structure of matter are discussed. The recently calculated probabilities for atomic capture of mesons in light atoms and the calculated rates of mesoatomic processes in a mixture of hydrogen isotopes are presented. (auth)

Collision Phenomena

Refer also to abstracts 10158, 10235, 10261, 10268, 10286, 10337, and 11074.

10288 (BUP-74) SEMICLASSICAL APPROXIMATION FOR L- AND M-SHELL COULOMB IONIZATION BY HEAVY CHARGED PARTICLES. Kocbach, L. (Bergen Univ. (Norway). Dept. of Physics). Aug 1975. 58p. Dep. NTIS (US Sales Only) $5.50.

The semiclassical approximation with straight line trajectories is applied to the Coulomb ionization of K-, L- and M-shells by heavy charged particles. The calculational aspects are discussed in detail. Scaling relations for the experimentally relevant quantities are derived. The theoretical predictions are compared with experiment. The relation of the present work to earlier SCA results and the PWBA results is discussed in detail. (auth)

10289 (CNRS-CPT-75-P-724) LOCALIZED AND DISPERSIVE STATES IN THE MULTIPHOTON IONIZATION PROCESSES. Richard, J. L. (Centre National de la Recherche Scientifique, 13-Marseille (France). Centre de Physique Theorique). Apr 1975. 6p. INIS.

The notion of localized and dispersive states is introduced in the problem of multiphoton ionization of atoms by a laser beam. The connection is made with the ionization probability. (FR)

10290 (CONF-750975-2) MULTIPLE ELECTRON LOSS CROSS SECTIONS FOR 60 MeV I^{+10} IN SINGLE COLLISIONS WITH XENON. Bridwell, L. B.; Biggerstaff, J. A.; Alton, G. D.; Jones, C. M.; Miller, P. D.; Kessel, Q.; Wehring, B. W. (Murray State Univ., Ky. (USA)). 1975. 8p. Dep. NTIS $4.00.

From fourth international conference on beam-foil spectroscopy; Gatlinburg, Tennessee, USA (15 Sep 1975).

Single scattering events of 60 MeV I^{10+} ions and Xe target atoms were observed to obtain cross sections for the loss of several electrons in a single collision. The experimental apparatus is described, and results are shown for charge state distributions at two Xe gas cell pressures and differential scattering cross sections for single collision electron removal at three different angles. 3 figures, 1 table (GHT)

10291 (CONF-750975-6) AUTOIONIZING STATES IN THE ALKALIS. Pegg, D. J. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., Tenn. (USA)). 1975. 16p. Dep. NTIS $4.50.

From 4th international conference on beam-foil spectroscopy; Gatlinburg, Tennessee, USA (15 Sep 1975).

Autoionization measurements are presented for collisionally excited states of lithium, sodium, magnesium, and potassium. Excitation was accomplished by passing a 70 keV beam of the alkali ions through a gas cell containing helium. Details of the experimental apparatus are given and electron spectra of the excited atoms are shown. 6 figures, 4 tables, 26 refs (GHT)

10292 (CONF-750975-8) ANGULAR DISTRIBUTION STUDIES OF NON-CHARACTERISTIC X-RADIATION. Thoe, R. S.; Sellin, I. A.; Liao, K. A.; Peterson, R. S.; Pegg, D. J.; Forester, J.; Griffin, P. M. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., Tenn. (USA)). 1975. 6p. Dep. NTIS $4.50.

From 4th international conference on beam-foil spectroscopy; Gatlinburg, Tennessee, USA (15 Sep 1975).

Measurements of polarization of the non-characteristic x-radiation emitted from collisions between energetic (10–90 MeV) Al ions in thin foils are presented. 2 figs (GHT)

10293 (COO-1265-170, pp 216-224) IMPACT PARAMETER DEPENDENCE OF K-SHELL VACANCY PRODUCTION BY CHARGED PARTICLES. Clark, D. L.; Greenlees, G. W.; Broadhurst, J. H.; Cage, M. E.; Li, T. K. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10294 (COO-1265-170, pp 225-229) L-SUBSHELL IONIZATION CROSS SECTIONS FOR URANIUM BY CHARGED PARTICLE BOMBARDMENT. Li, T. K.; Clark, D. L.; Greenlees, G. W. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10295 (COO-3129-41) EXPERIMENTAL CHEMICAL KINETICS: A STUDY OF CHEMICAL REACTIONS BY MEANS OF MOLECULAR BEAM TECHNIQUES. Progress Report, October 1974–October 1975. Greene, E. F. (Brown Univ., Providence, R. I. (USA)). Oct 1975. Contract AT(11-1)-3129. 8p. Dep. NTIS $4.50.

Beams of electrons are shown to be able to control the motions of neutral molecules. A beam of electrons coaxial with a neutral beam of KCl molecules can restrict the divergence of the KCl beam to increase its signal on a detector by up to a factor of 10^4. Further, an electron beam can pump molecules from the residual gas in a vacuum chamber by forcing them to move preferentially along the electron beam into another chamber where they are detected by a mass spectrometer. Inelastic scattering of CsI by Ar and Xe and of CsCl by Ar with velocity selection and analysis at thermal energies shows large cross sections for the transfer

of energy in amounts up to several vibrational quanta for both excitation and deexcitation of the molecules. The reaction LiCl + H yields Li + HCl is studied as it occurs on a Re surface as are the yields of positive and negative ions formed from cesium halides incident on a Nb surface. (auth)

10296 (UCID-15644-75-2, pp 16) CHEMICAL MODELING AND THEORETICAL CHEMISTRY. Cross Sections for the Elastic and Inelastic Scattering of Electrons by Molecules. Bender, C. F.; Rescigno, T. N.; McCurdy, C. W.; McKoy, V. 3 Sep 1975.

In General Chemistry Division quarterly report, April–June 1975. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

10297 (UCRL-77311) COLLISIONAL QUENCHING OF METASTABLE X-RAY EMITTING STATES IN A FAST BEAM OF He-LIKE FLUORINE. Matthews, D. L.; Fortner, R. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Sep 1975. Contract W-7405-Eng-48. 10p. (CONF-750975-4). Dep. NTIS $4.50.

From 4th international conference on beam-foil spectroscopy; Gatlinburg, Tennessee, USA (15 Sep 1975).

High resolution x-ray spectral measurements are used to determine the relative intensity of He-like fluorine x-ray transitions, $2\ ^3P_1$ yields $1\ ^1S_0$ and $2\ ^1P_1$ yields $^1S_0$, produced in fluorine collisions with Ne, Ar, and Kr gas targets at various pressures and in thin carbon foils and a thick carbon slab. The relative intensities are observed to be strong functions of both target density and incident charge Z. These effects are attributed to strong collisional quenching of both initial states by subsequent large impact parameter collisions. The data permit extraction for the first time of the total quenching cross sections (sigma/sub Q/) for fast fluorine ions in both states. A strong enhancement of the relative intensity of the $2\ ^3P_1$ is observed for F^{7+} projectiles. This strong enhancement is attributed to selective excitation of metastable states in the beam, i.e., $1s2s\ ^3S_1$, into the $1s2p\ ^3P_1$ state. Finally, the data for foil and solid targets are used to obtain new information on the excitation states of ions moving in solids. High resolution measurements of the radiative electron capture (REC) peak are reported and analyzed for the first time. 3 figs, 1 table (auth)

10298 OUTER S-SHELL IONIZATION OF NEON, ARGON, AND KRYPTON BY H_2^+ AND H^+ IMPACT (100 keV TO 1000 keV). Hippler, R.; Schartner, K. H. (Giessen Univ. (F. R. Germany). 1. Physikalisches Inst.). Z. Phys., A; 273: No. 2, 123-127(Jun 1975).

7 figs.; 1 tab.; 13 refs.

The outer s-shell ionization of Ne, Ar, and Kr by H_2^+ and He^+ impact has been studied in the energy range of 100 keV to 1,000 keV. The observed structures in the ionization functions are explainable by molecular processes and by direct Coulomb ionization. (auth)

10299 EVALUATION OF COULOMB INTEGRAL. Tsu, T. S.; Wei, C. C.; Yeh, R. J.; Yu, H. Y. (National Tsing Hua Univ., Hsinchu, Taiwan). Chin. J. Phys. (Taiwan); 13: No. 1, 130-131 (Apr 1975).

The Coulomb integral is explicitly expressed in algebraic form by computer-oriented technique. (auth)

10300 ELECTRON IMPACT EXCITATION OF N^1S AND N^3S STATES OF He AT INTERMEDIATE ENERGIES. Scott, T.; McDowell, M. R. C. (Royal Holloway Coll., Englefield Green, Eng.). J. Phys., B (London); 8: No. 11, 1851-1865(1 Aug 1975).

Total and differential cross sections are calculated for electron impact excitation of the 2^1S, 2^3S and 3^1S states of helium in a distorted wave model at impact energies between 30 and 300 eV. The results are compared with other theoretical models and with recent absolute experimental measurements. (auth)

10301 APPARATUS TO MEASURE PRECISE TOTAL DIFFERENTIAL CROSS SECTIONS OF ELECTRONS SCATTERED BY GASES EMPLOYING AN ELECTRON COUNTING SYSTEM. Bennani, A. L.; Nguyen, B.; Pebay, J.; Lecas, M. (Paris Univ., Orsay, France). J. Phys., E (London); 8: No. 8, 651-655(Aug 1975).

A unit using an electron counting system has been built to measure total differential cross sections of electrons scattered by gases with several kilovolts incident energies. Typical features of the unit and its high precision possibilities are described in detail, compared to similar existing units. As an example, the total scattered intensities in the s (where $s = (4\pi/\lambda)(\sin\theta/2)$ is the classical electron diffraction parameter) range 0.45 $Å^{-1}$ to 32 $Å^{-1}$ with 30 keV electrons from CO_2 are presented. The results are compared to previously published measurements and the normalization technique is widely discussed. The difference function obtained by comparison with the predictions of the independent atom model shows doubly shaped oscillations which cannot be due to experimental uncertainty origin. (auth)

10302 ELECTRON IMPACT EXCITATION OF THE 2^3S STATE OF HELIUM: ABSOLUTE DIFFERENTIAL CROSS SECTION FROM THRESHOLD TO 3.6 eV ABOVE. Pichou, F.; Huetz, A.; Joyez, G.; Landau, M.; Mazeau, J. (Universite Pierre et Marie Curie, Paris). J. Phys., B (London); 8: No. 11, L236-L240(1 Aug 1975).

The absolute differential excitation cross section of the 2^3S state of helium at 90° scattering angle is obtained from threshold to 3.6 eV above. The energy transmission efficiency of the post-collision analyser of the electron impact spectrometer is obtained from the known characteristics of the ionization process near threshold. The results are made absolute by normalization to accurate elastic cross section of helium. Recently calculated cross sections are in good agreement with these measurements. (auth)

10303 RESONANCES IN THE TOTAL ELECTRON-IMPACT EXCITATION CROSS SECTION OF METASTABLE STATES OF HELIUM NEAR 60 eV. Bolduc, E.; Marmet, P. (Laval Univ., Quebec City, Canada). J. Phys., B (London); 8: No. 11, L241-L243(1 Aug 1975).

Two He resonances have been observed near 60 eV in the total cross section for the formation of metastable neutral helium. Comparison of measured resonance energies with values obtained by other methods shows that they result from the perturbation by the $(2s^22p)^2P$ and $(2s2p^2)^2D$ negative ion states. (auth)

10304 EFFICIENCY OF DEACTIVATION OF THE $B^3\Pi_{0_u^+}$ STATE OF MOLECULAR BROMINE IN COLLISIONS. Bugrim, E.D.; Makrenko, S.N.; Tsikora, I.L. Opt. Spectrosc. (USSR) 39: No. 1, 15-17 (July 1975).

Fluorescence in pure bromine and in mixtures of bromine with He, Ne, Ar, Kr, N_2, O_2, and CO_2 has been obtained and studied by the method of monochromatic excitation (Hg, λ=5461 Å). The cross sections of the nonradiative deactivation of the $B^3\pi_{0_u^+}$ state of the Br_2 molecule have been determined. The correlation of the cross sections with the Selwyn parameter has been studied, and a mechanism has been proposed for the nonradiative decay of the $B^3\pi_{0_u^+}$ state of molecular bromine in collisions. (auth)

10305 DIRECT VIBRATIONAL EXCITATION OF IONS AND MOLECULES VIA CHARGE EXCHANGE IN $N^+{}_2$–N_2, $O^+{}_2$–O_2, CO^+–CO, AND NO^+–NO COLLISIONS. Moran, T.F.; McCann, K.J.; Flannery, M.R. (Georgia Institute of Technology, Atlanta, Georgia 30332). J. Chem. Phys. 63: No. 9, 3857-3862 (1 Nov 1975).

Differential and integral cross sections for direct vibrational excitation in symmetric $N^+{}_2(X^2\Sigma^+_g, v_0')$–$N_2(X^1\Sigma^+_g, v_0'')$, $O^+{}_2(X^2\Pi_g, v_0'')$ –$O_2(X^3\Sigma^-_g, v_0')$, $CO\ (X^2\Sigma^+, v_0')$ –$CO(X^1\Sigma^+, v_0'')$ and $NO^+\ (X^1\Sigma^+, v_0')$–$NO(X^2\Pi_r, v_0'')$ collisions have been determined for ions with 0.004 to 2.2 keV kinetic energies. Inelastic channels in the individual symmetric ion–molecule systems are strongly coupled to each other and to the energy resonant charge exchange channels. Differential cross sections for excitation of individual inelastic product channels have been computed as a function of scattering angle using a multistate impact parameter description of the collision. Small angle scattering dominates and becomes more concentrated in the forward direction with increasing ion kinetic energy. Multistate integral cross sections for individual channels and integral cross sections summed over all product channels are presented as a function of both ion kinetic energy and reactant ion vibrational state. (auth)

10306 DISSOCIATIVE IONIZATION OF MOLECULES BY ELECTRON IMPACT. I. APPARATUS AND KINETIC ENERGY DISTRIBUTIONS OF D^+ IONS FROM D_2. Stockdale, J.A.D.; Anderson, V.E.; Carter, A.E.; Deleanu, L. (Health Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). J. Chem. Phys. 63: No. 9, 3886-3897 (1 Nov 1975).

A crossed beam apparatus for the study of electron impact dissociative ionization of molecules is described. D^+ time-of-flight and energy spectra are presented for impact of electrons on D_2, from energies near dissociative threshold to 300 eV. In addition to the group of D^+ ions peaking near 8 eV kinetic energy from dissociative ionization via the $^2\Sigma^+{}_u$ state of $D^+{}_2$, groups of ions of lower kinetic energy peaking near 5, 2, and possibly near 1 eV are observed. These ions appear to be due to excitation of states of D_2 or $D^+{}_2$ lying near to or above the $^2\Sigma^+{}_u$ state of $D^+{}_2$. (auth)

10307 DISSOCIATIVE IONIZATION OF MOLECULES BY ELECTRON IMPACT. II. KINETIC ENERGY AND ANGULAR DISTRIBUTIONS OF N^+ AND N^{++} IONS FROM N_2. Deleanu, L.; Stockdale, J.A.D. (Health Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). J. Chem. Phys. 63: No. 9, 3898-3906 (1 Nov 1975).

An apparatus containing crossed molecular and pulsed electron beams has been used to obtain distributions in kinetic energy and angle of fast (>1.5 eV) N^+ and N^{++} ions produced through dissociative ionization of N_2 by impact of electrons with energies from threshold to 300 eV. Previously unreported structure is found in both N^+ and N^{++} kinetic energy spectra. The angular distributions of N^+ (energy resolved) and N^{++} (total) ions are found to be substantially isotropic for electron beam–ion detector angles from 30°–110°. (auth)

10308 SEMICLASSICAL PERTURBATION SCATTERING BY A RIGID DIPOLE. Smith, F.T.; Huestis, D.L.; Mukherjee, D. (Stanford Research Institute, Menlo Park, California 94025); Miller, W.H. Phys. Rev. Lett. 35: No. 16, 1073-1076 (20 Oct 1975).

A uniform semiclassical S matrix has been developed for collisions of charged particles with rotating rigid dipoles, with use of first-order perturbation theory. The resulting expression is analytical, depending on tabulated functions, and trivial to calculate; it allows evaluations of quantum transitions in classically forbidden regions, and of quantum interference effects. (auth)

10309 CROSS SECTION FOR SINGLE AND DOUBLE IONIZATION OF N_2 AND O_2 MOLECULES BY ELECTRON IMPACT FROM THRESHOLD UP TO 170 eV. Märk, T.D. (Institut für Atomphysik der Universität Innsbruck, A 6020 Innsbruck, Osterreich). J. Chem. Phys. 63: No. 9, 3731-3736 (1 Nov 1975).

Absolute ionization cross sections have been measured for the processes $N_2+e\rightarrow N_2^++2e$, $N_2+e\rightarrow N_2^{++}+3e$, $O_2+e\rightarrow O_2^++2e$, and $O_2+e\rightarrow O_2^{++}+3e$ as a function of electron energy up to 170 eV in a crossed molecule–electron beam apparatus. The ionization cross section curve for producing the singly charged parent ions N_2^+ and O_2^+ is found to have at least one inflection of the type first observed by Lawrence for mercury. Using nth root extrapolation the following minimum ionization potentials were derived from the low energy cross section behavior: $N_2^+(X\,^2\Sigma_g^+)=15.6\pm0.1$ eV, $N_2^{++}(^3\Pi_u)=42.9\pm0.3$ eV, $O_2^+(X\,^2\Pi_g)=12.1\pm0.1$ eV, and $O_2^{++}(X\,^1\Sigma_g^+)=35.6\pm0.3$ eV. From distinct breaks in the single ionization cross section curve the following excited states were observed; $N_2^+(B\,^2\Sigma_u^+)=18.8\pm0.2$ eV, $O_2^+(a\,^4\Pi_u)=16.0\pm0.2$ eV, and $O^+(^2\Sigma_g^-)=21.0\pm0.2$ eV. In the double ionization cases, a square law was found from threshold up to some 20 eV above threshold. All results are compared with previous measurements if available. (auth)

10310 COLLISIONAL IONIZATION OF Na, K, AND Cs BY CO_2, COS, AND CS_2: MOLECULAR ELECTRON AFFINITIES. Compton, R.N.; Reinhardt, P.W. (Health Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830); Cooper, C.D. J. Chem. Phys. 63: No. 9, 3821-3827 (1 Nov 1975).

The negative ion products resulting from collisions between orthogonal beams of alkali metal atoms (Na, K, Cs) and the linear triatomic molecules CO_2, COS, and CS_2 have been studied from threshold to ~400 eV (lab). Ions with masses corresponding to the parent molecules CO_2, COS, and CS_2 are detected for all collision permutations except for Na colliding with CO_2. The following electron affinities are deduced from measurements of the threshold for the ion pair production reactions: $CO_2(-0.60\pm0.2$ eV), $COS(+0.46\pm0.2$ eV), and $CS_2(1.0\pm0.2$ eV). The CO^-_2 ion was found to be metastable with respect to autodetachment. This result is compatible with the negative electron affinity for CO_2 and in agreement with our earlier observations of $CO^-_2{}^*$ and with recent theoretical calculations. The lifetime of $CO^-_2{}^*$ ($9\pm2\times10^{-5}$ sec) was measured to be independent of collision energy over the region of energy studied (threshold to ~20 eV c.m.). The fragment ions O^-/CO_2, O^-/COS, S^-/COS, and S^-/CS_2 were detected at a threshold energy which is consistent with the known energetics of the reactions. These results are compared with recent dissociative electron attachment studies. (auth)

10311 SINGULARITIES OF THE BORN–OPPENHEIMER EXCHANGE AMPLITUDE. Huo, W.M. (Department of Chemistry, Mellon Institute of Science, Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213). J. Chem. Phys. 63: No. 9, 4013-4016 (1 Nov 1975).

Born–Oppenheimer amplitude for exchange collisions of electrons by atoms or molecules is found to possess singularities in the complex k_0, k_f, and K plane, where k_0, k_f, and K denote the magnitudes of the incoming, outgoing, and momentum change vectors, respectively. The locations of the singularities are investigated using analytic Hartree–Fock wavefunctions as well as correlated wavefunctions for the target and are found to be related to the asymptotic behavior of the target electron undergoing exchange. (auth)

10312 RECOMBINATION DYNAMICS OF HYDROGEN ON A TUNGSTEN SURFACE. McCreery, J.H.; Wolken, G. Jr. (Battelle Columbus Laboratories, Columbus, Ohio 43201). J. Chem. Phys. 63: No. 9, 4072-4073 (1 Nov 1975).

The results of a series of classical trajectory calculations designed to simulate the recombination of two hydrogen atoms adsorbed on tungsten to form a gas phase H_2 molecule are reported. (AIP)

10313 MANY-BODY GREEN'S-FUNCTION METHOD FOR ELECTRON SCATTERING FROM OPEN-SHELL SYSTEMS. Yaris, R.; Taylor, H.S. (Lehrstuhl für Theoretische Chemie, Technische Universität München, München, Germany). Phys. Rev. A 12: No. 5, 1751-1759 (Nov 1975).

It is shown how the many-body Green's-function method, previously developed by the authors for treating elastic and inelastic electron scattering of closed-shell systems, can be extended to open-shell systems. The method can now be applied to all open-shell systems where at least one of the members (generally those of highest and lowest multiplicity) of the degenerate multiplet can be adiabatically connected to a single-determinant unperturbed state. The resulting S matrix is the sum over partial-wave S-matrix elements for the highest (or lowest) multiplicity state—all of which elements can be calculated by the standard many-body Green's-function techniques, which have been developed for closed-shell systems—weighted with the appropriate transformation matrix elements and Clebsch-Gordan coefficients. (auth)

10314 INELASTIC ELECTRON-HYDROGEN SCATTERING IN THE UNRESTRICTED GLAUBER APPROXIMATION. Gau, J.N.; Macek, J. (Behlen Laboratory of Physics, Unversity of Nebraska–Lincoln, Lincoln, Nebraska 68508). Phys. Rev. A 12: No. 5, 1760-1770 (Nov 1975).

The double-integral expression derived previously for Bryon's unrestricted Glauber approximation has been evaluated numerically to obtain scattering amplitudes for elastic collisions of electrons on hydrogen, as well as $2s$ and $2p$ excitation. The resulting values of cross sections and Ly-α polarization fractions are similar to previous Glauber calculations, but the alignment and orientation of Ly-α radiation as a function of scattering angle is markedly different from the predictions of the Born and conventional Glauber calculations. (auth)

10315 FULL FIRST BORN APPROXIMATION FOR INNER-SHELL PICKUP IN HEAVY-ION COLLISIONS. Halpern, A.M. (Department of Physics, Brooklyn College of the City University of New York, Brooklyn, New York 11210); Law, J. Phys. Rev. A 12: No. 5, 1776-1780 (Nov 1975).

We have calculated K-shell pickup cross sections using the full first Born approximation developed by Jackson and Schiff for a number of heavy-ion collisions for which experimental data have recently become available. These include protons on argon at a range of velocities and fully stripped ions $Z = 1, 6, 7, 8, 9$, on argon at three velocities. The calculations attempted to include the effect of screening by target electrons with a crude effective potential. We conclude that the full first Born charge-exchange cross section gives nonphysical results for the systems examined, thus casting further doubt on the theoretical significance of the good agreement with experiment one obtains for protons on hydrogen. (auth)

10316 COHERENT EXCITATION OF THE $n = 3$ STATES IN HYDROGEN. Krotkov, R. (Department of Physics and Astronomy, University of Massachusetts, Amherst, Massachusetts 01002). Phys. Rev. A 12: No. 5, 1793-1800 (Nov 1975).

This paper is a theoretical discussion of a "coherence effect" in the excitation of hydrogen atoms to the $n = 3$ state by electron bombardment. By coherence is meant that the density matrix describing the atom after the collision has off-diagonal matrix elements in the field-free basis. The differential cross section for producing Balmer-α photons at 90° to the electron beam is calculated as a function of an applied longitudinal electric field. The off-diagonal elements show up as a dependence of the observed light on the directions of the electric field. Theoretical results based on the Born approximation are compared with an experiment at 200 and 500 eV. It is pointed out that this method for measuring relative phases of scattering amplitudes can be generally applied and is not restricted to $n = 3$ excitation of hydrogen. (auth)

10317 RADIATIVE CAPTURE OF HIGH-ENERGY ELECTRONS. Lee, C.M.; Pratt, R.H. (Department of Physics, University of Pittsburgh, Pittsburgh, Pennsylvania 15260). Phys. Rev. A 12: No. 5, 1825-1829 (Nov 1975).

A simple theoretical method for calculating radiative capture cross sections is proposed. Applying the quantum defect theory, the radiative capture process and the tip bremsstrahlung process are treated together on the same footing. An application to radiative capture of 50-keV electrons by Au^{+49} ions is presented. (auth)

10318 CHARGE-EXCHANGE FORMATION OF THE $^2P_{3/2}$ AND $^2P_{1/2}$ STATES OF Ar^-. Edwards, A.K. (Department of Physics and Astronomy, University of Georgia, Athens, Georgia 30602). Phys. Rev. A 12: No. 5, 1830-1834 (Nov 1975).

The $^2P_{3/2,1/2}$ doubly excited states of Ar^- are formed by charge exchange of O^- and H^- ion beams with argon. Measurements of the angular distribution of autodetached electrons from these states yield the relative populations of the M_J magnetic substates for the $^2P_{3/2}$ state. A drop in the cross section for the formation of both J states is seen near 1.5 keV for H^--on-Ar exchange collisions. (auth)

10319 USE OF SEMICLASSICAL COLLISION THEORY TO COMPARE ANALYTIC FITS TO THE INTERACTION

POTENTIAL FOR VIBRATIONAL EXCITATION OF H_2 BY He. Duff, J.W.; Truhlar, D.G. (Chemical Dynamics Laboratory, Department of Chemistry, University of Minnesota, Minneapolis, Minnesota 55455). J. Chem. Phys. 63: No. 10, 4418-4429 (15 Nov 1975).

Vibrational transition probabilities for strongly classically forbidden single-quantum and two-quantum transitions calculated by two semiclassical methods involving real-valued trajectories are compared to quantum mechanical close coupling for various analytic fits to the *ab initio* interaction potential for the He–H_2 system. The final-value-representation integral expression from classical S matrix theory and the classical-trajectory forced-quantum-oscillator method are found to be in semiquantitative agreement with the quantum mechanical calculation even for transition probabilities as small as about 10^{-6}. Further, the semiclassical methods reproduce the important trends in the results as functions of the interaction potential. The reliability of these semiclassical calculations allows one to determine the region of the potential energy surface which is sufficient for calculation of vibrational excitation probabilities. The important region for the present calculations is in the classically allowed region of the potential energy surface and at the fairly high total energy of 0.14 hartree includes the range of H_2 distances 1.195–1.467 bohr for the forced quantum oscillator methods and the wider range 0.927–2.000 bohr for the more accurate final value representation. The region which must be known for an accurate calculation is more restricted than previous discussions had suggested. At lower energies, an even more restricted range of the potential energy surface contributed to the semiclassical calculations. (auth)

10320 ELASTIC SCATTERING OF 13 TO 100 eV ELECTRONS FROM N_2. Finn, T.G.; Doering, J.P. (Department of Chemistry, The Johns Hopkins University, Baltimore, Maryland 21218). J. Chem. Phys. 63: No. 10, 4399-4404 (15 Nov 1975).

The cross section for elastic scattering of electrons from N_2 has been measured between 13 and 100 eV. The relative differential cross sections for elastic scattering and for excitation of the $C\,^3\Pi_u$ $v=0$ and 1 bands were measured over the angular range from 20° to 90° in the 13–35 eV region and from 5° to 90° in the 40–100 eV region. The integrated cross sections were placed on an absolute basis by normalizing the $C\,^3\Pi_u$ $v=0$ excitation cross section to the known emission cross section for the Second Positive system of nitrogen ($C\,^3\Pi_u \rightarrow B\,^3\Pi_g$) and by calibrating the electron spectrometer with respect to other electron scattering results. The total elastic scattering cross section varies from 12.3×10^{-16} cm^2 (±50%) at 13 eV to 3.9×10^{-16} cm^2 (±50%) at 100 eV. (auth)

10321 VALIDITY OF APPROXIMATE METHODS IN MOLECULAR SCATTERING: THERMAL HCl–He COLLISIONS. Green, S. (Goddard Institute for Space Studies, New York, New York 10025); Monchick, L. J. Chem. Phys. 63: No. 10, 4198-4205 (15 Nov 1975).

Accurate close coupling scattering calculations are presented for thermal energy HCl–He collisions. The interaction potential is obtained from the Gordon–Kim electron gas model, adjusted to have the correct long-range multipole form. A variety of phenomenological cross sections are computed from the close coupling S matrix, and these are compared with results from several commonly employed approximate methods. In particular, it is found that the total integral, total differential, and gas kinetic cross sections are accurately predicted by the central field approximation which retains just the spherical average of the interaction. Integral inelastic cross sections are represented quite accurately by the coupled states approximation of McGuire and Kouri, but only qualitatively by the effective potential method of Rabitz. Pressure broadening cross sections from the close coupling calculation are in much better agreement with experiment than either Anderson theory calculations or the classical trajectory study of Gordon. NMR spin–lattice relaxation cross sections are also presented. (auth)

10322 VIBRATIONAL ENERGY TRANSFER IN MOLECULAR COLLISIONS: AN INFORMATION THEORETIC ANALYSIS AND SYNTHESIS. Procaccia, I.; Levine, R.D. (Department of Physical Chemistry, The Hebrew University, Jerusalem, Israel). J. Chem. Phys. 63: No. 10, 4261-4279 (15 Nov 1975).

State-to-state rate constants for vibrational energy transfer (both V–V and V–T) are characterized using an "exponential gap" representation. The collisions analyzed include experimental results for both V–T and V–V transfer rates, trajectory computations for V–T transfer rates (via both inelastic and reactive, atom exchange, collisions) and quantal computations for V–V transfer rates. The results are analyzed in terms of the surprisal, a measure of deviation of the actual rate from the prior (or reference) rate. The prior rates are computed on the basis of the assumption that (at a given collision energy) all final states are equally probable. For almost all cases the surprisal could be characterized by a single parameter. The magnitude of this parameter (and its temperature dependence) could be predicted using bulk averages only. Such predictions are demonstrated for both experimental and trajectory computed rates. The link between the microscopic dynamics and macroscopic kinetics is forged by the use of sum rules (which provide constraints on the rates) and of the principle of maximal entropy (which is used to determine the least biased set of rate constants subject to the constraints). (auth)

10323 ENERGY ABSORPTION BY N_2O IN THE 4 TO 14 eV REGION. Huebner, R.H. (Argonne National Laboratory, Argonne, Illinois 60439); Celotta, R.J.; Mielczarek, S.R.; Kuyatt, C.E. J. Chem. Phys. 63: No. 10, 4490-4494 (15 Nov 1975).

Apparent oscillator-strength values for transitions in the 4 to 14 eV region in nitrous oxide have been derived from electron energy-loss measurements. Detailed comparison with photoabsorption measurements in the ultraviolet region indicates a weak transition below the $^1\Delta \leftarrow \tilde{X}\,^1\Sigma^+$ transition at 6.8 eV not observed optically. This analysis also provides oscillator-strength values in the region between 11.5 and 12.4 eV, where no quantitative photoabsorption data are available. (auth)

10324 SMALL-ANGLE SCATTERING OF HYDROGEN ATOMS AND PROTONS IN VARIOUS GASES. Thomas, E.W.; Leatherwood, L.A.; Harriss, J.E. (School of Physics, Georgia Institute of Technology, Atlanta, Georgia 30332). Phys. Rev. A 12: No. 5, 1835-1839 (Nov 1975).

Cross sections have been measured for the differential (in angle) scattering of 15-keV H^+ and H^0 in targets of He, Ar, H_2, and N_2. Separate cross sections are presented for scattering projectiles in the singly charged (H^+), neutral (H^0), and negatively charge (H^-) states; scattering angles range from 0.5 to 10 deg. Summing these constituent cross sections we arrive at a "total" cross section for scattering all projectiles into a particular angle. This "total" differential cross section is compared with predictions using a simple screened Coulomb potential; for the molecular targets the cross section is taken to be twice that for the corresponding atom. For H^+ and H^0 impact on He and H_2 the measured cross section agrees with the predicted value; in these cases the effect of screening is negligible. For H^+ and H^0 impact on Ar and N_2 the measurements agree fairly well with the screened Coulomb calculation at angles up to 1.5 deg and then fall lower than the predictions at larger angles; theory and experiment differ by a factor of 2 at 10 deg in one case. For all cases considered the formation of scattered H^- ions occurs in less than 2% of the collision events. (auth)

10325 EXPERIMENTAL DEFINITION OF VALENCE-SHELL AND CUMULATIVE-SHELL COMPTON PROFILES FROM 25-keV ELECTRON-IMPACT STUDIES ON N_2, Ne, AND Ar. Wong, T.C.; Lee, J.S.; Wellenstein, H.F.; Bonham, R.A. (Department of Chemistry, Indiana University, Bloomington, Indiana 47401). Phys. Rev. A 12: No. 5, 1846-1858 (Nov 1975).

The maximum and high-energy loss side of the Bethe ridge, obtained from high-energy electron-impact spectroscopic observations with 25-keV electrons, has been interpreted in terms of an effective Compton profile, $J_{eff}(q, K)$ defined in terms of the absolute generalized oscillator strength (GOS) $f(K, E)$ as $J_{eff}(q, K) = (2K^2/E)\, f(K, E)$, where q is $(E-K^2)/2K$ with K the momentum transfer and E the energy loss. It is well known that for He and H_2 this effective profile for constant q approaches the x-ray Compton profile in the limit of large K for fixed but large incident-electron energy. We report here the discovery of plateaus in the envelope of $J_{eff}(q, K)$ for constant q with increasing K, in addition to the x-ray profile limit, for target systems containing more than one shell. In the cases of N_2 and Ne, an additional plateau is observed which is associated with the outer-shell electrons because the maximum of the Bethe ridge has not yet reached the energy-loss region of core or K-shell excitations. This additional plateau makes it possible to define an effective outer-shell Compton profile. In the case of argon, two plateau regions are observed before the Bethe ridge reaches the K-shell contributions and effective profiles are defined for the M and M-plus-L shells. Comparisons with theory suggest that the cumulative-shell Compton profiles agree with direct theoretical computations utilizing the x-ray formula but including only contributions from the shell(s) in question at the 5% accuracy level. On the other hand, computations of the GOS using explicit final-state ion wave functions agree with our experiments at the (1–2) % level. (auth)

10326 ELASTIC POSITRON–HYDROGEN-MOLECULE SCATTERING USING THE EIKONAL APPROXIMATION. Bhattacharyya, P.K. (Department of Physics, University College of Science, University of Calcutta, Calcutta 700009, India); Ghosh, A.S. Phys. Rev. A 12: No. 5, 1881-1884 (Nov 1975).

An eikonal approximation has been used to investigate the elastic positron–hydrogen-molecule scattering problem. The effective potential used here includes the static as well as the polarization potentials. The spherical and the nonspherical parts of both potentials are taken into consideration. The results have been obtained from 0.1 to 50 eV. The results for the elastic cross section are found to be very close to the experimental findings below the positronium-formation threshold. The effect of the polarization potential is found to be appreciable even up to 50 eV. (auth)

10327 THEORY OF ELECTRON-MOLECULE SCATTERING: COMMENTS ON THE ADIABATIC-NUCLEI APPROXIMATION. Shugard, M.; Hazi, A.U. (Department of Chemistry, University of

California, Los Angeles, California 90024). Phys. Rev. A 12: No. 5, 1895-1902 (Nov 1975).

The adiabatic-nuclei theory of electron-molecule scattering is extended to account for electronic excitation of the target. The approximate expressions for the wave function and the scattering amplitude are derived from a formally exact expansion in terms of the fixed-nuclei, electronic-scattering solutions. The formalism treats molecular-bound and continuum states on an equal footing. We also propose a modified expression for the adiabatic-scattering amplitude which is expected to have an increased range of validity near excitation thresholds. (auth)

10328 HIGH-RESOLUTION LINE BROADENING AND COLLISIONAL STUDIES IN CO_2 USING NONLINEAR SPECTROSCOPIC TECHNIQUES. Meyer, T.W.; Rhodes, C.K. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550); Haus, H.A. Phys. Rev. A 12: No. 5, 1993-2008 (Nov 1975).

High-resolution line-broadening studies have been made of CO_2 in collision with a wide variety of foreign gas perturbers. These measurements have been made by observation of the narrow saturated resonance in the 4.3-μm fluorescence emitted from a low-pressure CO_2 gas which is subjected to a saturating standing-wave electric field from a CO_2 oscillator operating on a 9.6- or 10.6-μm transition. The collision partners which have been investigated are CO_2, N_2O, N_2, NO, CO, O_2, H_2, D_2, ^3He, ^4He, Ne, Ar, Kr, Xe, NH_3, and CH_4. A semiclassical theory of the 4.3-μm saturated resonance is developed which accounts for the effects of phase-interrupting collisions, beam transit time, and optical intensity. The observation of a previously unobserved downward curvature of the CO_2 linewidth data at low pressure is attributed to the influence of the transit-time effect. The experimentally determined pressure-broadening coefficients include the important correction for the contribution of power broadening. These power-corrected results for CO_2, N_2, and ^4He have been used to predict successfully the observed gain characteristics of high-pressure (>1 atm) CO_2 amplifiers, as observed in other studies. We have also appraised our observed broadening coefficients in the context of the pressure-broadening theory developed by Murphy and Boggs in order to characterize quantitatively the intermolecular interactions. The comparison of theory and experiment indicates the need for an explicit incorporation of vibration perturbations in the theoretical analysis, particularly when vibrational resonance is present. (auth)

10329 MODIFICATION OF GLAUBER THEORY FOR DYNAMIC SCATTERING OF ELECTRONS BY POLYATOMIC MOLECULES. Bartell, L.S. (Department of Chemistry, The University of Michigan, Ann Arbor, Michigan 48104). J. Chem. Phys. 63: No. 9, 3750-3755 (1 Nov 1975).

In its original form, Glauber scattering theory achieves a considerable simplification by neglecting several factors of modest consequence in atomic scattering but of importance in molecular scattering. These include, in particular, the spread of the shadow cast by a scatterer as a wave propagates downstream in the target. Although such effects do not matter in the original range of validity of the theory, the characteristic distances in molecules restrict the unmodified theory to an excessively small angular range. The present treatment introduces phase factors to take into account the distribution of scatterers in the incident direction and the propagation of the scattered waves in the target. This appreciably extends the formal range of applicability. (auth)

10330 DISSOCIATION OF H^+_3 TO FORM METASTABLE HYDROGEN. Thomas, E.W.; Fitzwilson, R.L.; Sauers, I.; Ford, J.C. (School of Physics, Georgia Institute of Technology, Atlanta, Georgia 30332). J. Chem. Phys. 63: No. 9, 4092-4093 (1 Nov 1975).

The differential cross section for the formation of metastable hydrogen atoms from H^+_3 is measured for the system of H^+_3 beam scattering on a gas target of H_2, Ar, and N_2. (AIP)

10331 *K*-SHELL IONIZATION OF CARBON BY 1- TO 18-MeV PROTONS. Burch, D. (Department of Physics, University of Washington, Seattle, Washington 98195). Phys. Rev. A 12: No. 5, 2225-2226 (Nov 1975).

Cross sections for *K*-shell ionization have been determined from relative x-ray yields normalized to Auger-electron-production data at low proton energies. The asymptotic form of the plane-wave Born approximation reproduces the data at high energies, but the binary encounter approximation underestimates the cross sections in this region by a factor of 2. (auth)

10332 LIMITATION ON NUMERICAL BOUNDS ON TRANSITION PROBABILITIES. Shakeshaft, R. (Department of Physics, New York University, New York, New York 10003). Phys. Rev. A 12: No. 5, 2230-2233 (Nov 1975).

The effect of neglecting ionization in the calculation of numerical bounds on transition probabilities is examined for proton–hydrogen-atom scattering, and it is found to be significant. This implies that numerical bounds on transition probabilities must necessarily be of limited accuracy, since it does not appear to be possible to take ionization even partially into account without the bounds becoming infinite. (auth)

10333 REPLY TO "LIMITATION ON NUMERICAL BOUNDS ON TRANSITION PROBABILITIES". Storm, D. (The Institute for Physical Sciences, The University of Texas at Dallas, P. O. Box 688, Richardson, Texas 75080). Phys. Rev. A 12: No. 5, 2234-2236 (Nov 1975).

It is demonstrated that a good share of the error Shakeshaft attributes to the failure to account for ionization in customary impact-parameter calculations for proton–hydrogen-atom scattering amplitudes really results from the inadequacy of the traveling hydrogenic basis set to account for the dynamic polarization of the hydrogen atom by the moving proton. The lower limit for the first-order bound can be reduced by using hydrogenlike basis functions that allow for this polarization. Bounds on the cross sections obtained by using the bound Δ_1 need not be infinite. The inclusion of time-dependent adjustable parameters in the basis functions provides a method for modifying the projection of the deviation vector or error term in the Schrödinger equation in the continuum. The exploratory work of Storm and Rapp appears to offer hope that reasonably accurate bounds on at least the 1*s* charge exchange amplitudes and cross sections can be obtained by employing only square-integrable basis functions that contain time-dependent variable parameters. However, if it is necessary to account for the flux in the ionization channels, it is shown that an account could be made without the bound becoming infinite. (auth)

10334 COMPARISON OF MONTE CARLO AND CONTINUOUS SLOWING-DOWN APPROXIMATION TREATMENTS OF 1-keV PROTON ENERGY DEPOSITION IN N_2. Porter, H.S.; Green, A.E.S. (University of Florida, Gainesville, Florida 32611). J. Appl. Phys. 46: No. 11, 5030-5038 (Nov 1975).

Monte Carlo (MC) and continuous slowing-down approximation (CSDA) calculations of proton energy deposition are compared for the same set of detailed atomic cross sections (DACS). It is found that the MC and CSDA results for the gross features of energy deposition, such as the eV/ion pair, and efficiency for excitation of a given state, are in reasonably good agreement. The spatial apportionment of energy shows disparities, particularly for particles which have degraded to energies less than about 100 eV. Energy spreading of the proton beam is found to be appreciable in the MC calculation, but appears to have a relatively small influence on the spatial distributions of excitation in comparison with CSDA, especially for high-lying states. Range straggling is found in the MC calculations, but it also appears to have only a small influence on the final results when compared with CSDA. Significant differences appear in the mean proton and hydrogen beam fraction obtained from MC and from CSDA. For the convenience of applications, the proton and hydrogen differential flux at each depth in the gas obtained from the MC results is represented analytically. (auth)

10335 SCATTERING OF LOW ENERGY He^{2+} IONS BY Ne, Ar, AND Kr ATOMS. Austin, T. M.; Mullen, J. M.; Bailey, T. L. (Florida Univ., Gainesville (USA). Dept. of Physics and Astronomy). Chem. Phys. (Amsterdam); 10: No. 1, 117-130(Aug 1975).

Experimental studies of collisions of He^{2+} ions with Ne, Ar, and Kr atoms have been carried out at laboratory kinetic energies in the range $8 \leq E_l \leq 60$ eV. For each collision pair, relative differential cross sections for elastic scattering and for the formation of He^+ by single charge transfer [e.g., $He^{2+} + R = He^+ + (R^+)^*$] were measured. Information concerning the initial states of the transfer products was also obtained, from measurements of the kinetic energy distribution of the He^+ ions. It is likely that charge transfer in the He^{2+}–Ne system proceeds via a single exothermic channel only: $He^{2+} + He = Ne^+(2s2p^6\ ^2S) + He^+(^2S)$, whereas for the other systems, transfer proceeds via a number of channels. The He^+–ion kinetic measurements indicated that for He^{2+}, Ar both Ar^+ and Ar^{2+} are formed in transfer, and that for He^{2+}, Kr only Kr^{2+} (and no Kr^+) was formed. The differential elastic scattering patterns were analyzed by means of cross section calculations based on an approximated form of the optical model. These calculations indicated that the pronounced shoulders observed in the $\sigma_{el}\ \theta$ versus θ curves arose from scattering from an attractive potential well, in the presence of concurrent inelastic scattering. Using parametrized Morse potentials to represent the ground electronic states of $(HeNe)^{2+}$ $(HeAr)^{2+}$, and $(HeKr)^{2+}$, the corresponding well-depths are estimated to be, respectively: 1.0 eV, 2.1 eV and 2.6 eV. (NL)

10336 DISSOCIATION OF HYDROGEN MOLECULES IN COLLISIONS WITH LIGHT ALKALI IONS. III. Comparison of Experiment with a Simple Hard Spheres Model. Kendall, G. M.; Schoettler, J.; Toennies, J. P. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen (F. R. Germany)). Chem. Phys. (Amsterdam); 10: No. 1, 87-94(Aug 1975).

A simple hard spheres model is used to calculate cross sections for the dissociation of a light homonuclear molecule in collisions with an alkali ion. The results are analyzed in terms of the relative contribution of different types of binary collision sequences. In agreement with experiment, the number of "simple" spectator collisions is found to depend strongly on the effective collision diameter. The model is shown to break down in the simulation of

certain collision sequences and thus it cannot explain the measured inelastic differential cross section at all scattering angles. The model does work, however, for backward large angle scattering near 180° for which the largest amount of experimental data is available. The model is used to extract potential parameters for the ion-atom two body interactions potential. These are in reasonable agreement with previous determinations. (NL)

Atomic Theory

Refer also to abstracts 10288 and 10486.

10337 (COO-1674-113) BASIC STUDIES OF ATOMIC DYNAMICS. Progress Report, October 1, 1974–September 30, 1975. Fano, U. (Chicago Univ., Ill. (USA)). 1 Oct 1975. Contract E(11-1)-1674. 9p. Dep. NTIS $4.50.

Topics covered include: fitting many-body theories into the theory of atomic spectra and collisions; variation of atomic properties along the periodic system; angular distribution of collision products (electron-atom collisions); application of atomic points of view to crystal lattice phenomena; and double photoionization of neon. (GHT)

10338 VARIATIONAL METHOD FOR CALCULATIONS OF THE GROUND STATE ENERGY. Freudenhammer, A. (Technische Univ. Braunschweig (F. R. Germany). Inst. A fuer Theoretische Physik). Z. Naturforsch.; 30A: No. 6/7, 721-727(Jun 1975). (In German)

4 figs.; 13 refs.

For Hamiltonians without any symmetry properties, a variational method for the calculation of the ground state energy is proposed. The numerical computation for the case of the few-electron-problem is based on the evaluation integrals. (auth)

10339 *B*-SPLINE EXPANSION BASES FOR EXCITED STATES AND DISCRETIZED SCATTERING STATES. Shore, B.W. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). J. Chem. Phys. 63: No. 9, 3835-3840 (1 Nov 1975).

High-order *B*-splines provide effective basis functions for constructing solutions to the Schrödinger equation. For high-lying levels of the Morse potential septic splines yield an accuracy comparable to harmonic oscillators. They can also approximate hydrogenic wavefunctions; typically one-third of the N eigenvalues of an $N \times N$ matrix are more accurate than 0.01%. Matrix eigenvectors can also represent scattering states. The approximation is uniformly valid spatially when basis functions terminate sharply. (auth)

10340 TOWARDS THE DEVELOPMENT OF THE QUANTUM MECHANICS OF A SUBSPACE. Srebrenik, S.; Bader, R.F.W. (Department of Chemistry, McMaster University, Hamilton, Ontario, Canada L8S 4M1). J. Chem. Phys. 63: No. 9, 3945-3961 (1 Nov 1975).

The development of the quantum mechanics for a subspace of a total system is pursued via the derivation or introduction of the following: (1) the variational principle for a subspace; (2) the relationship between the time dependent subspace average of an operator and its associated commutator; (3) the unique set of quantum properties found for a subspace bounded by a surface of zero flux as defined by $\nabla\rho(\mathbf{r}) \cdot n(\mathbf{r}) = 0, \forall\, \mathbf{r} \in S(\mathbf{r})$, and denoted as a "virial fragment"; (4) the special variational properties of the zero-flux boundaries in one-electron systems; (5) operators which cause the energy integral to be stationary over a subspace; (6) the fragment virial theorem; (7) the importance of the scaling of the coordinates of a single electron in the determination of subspace properties; (8) a reformulation of the total Hamiltonian for a many-particle system as a sum of single-particle Hamiltonians through the use of a complete set of virial sharing operators; (9) new interpretation of the energy of the equilibrium geometry of a fixed-nucleus Hamiltonian and of the kinetic and potential energies in the molecular virial theorem as purely electronic; (10) a proof that the energy for a molecule in an equilibrium geometry is a sum of one-electron contributions; (11) the crucial nature of the principle stated in (10) for the definition of the energy of a subspace; (12) introduction of the principle of equal sharing of the energy of interaction between identical particles into the definition of a subspace energy; (13) a proof of the nonpartitionability of an atom based on the principle outlined in (12); (14) discussion of the information required to define a fragment and its energy. As a consequence of the above theorems and results there emerges a unique definition of a unit cell in a solid, of an atomiclike fragment in a molecule and of a molecule in a system of interacting molecules, for these are the subsystems bounded by surfaces of zero flux. (auth)

10341 PSEUDOPOTENTIAL TRANSFORMATION OF CORRELATED-PAIR EQUATIONS. Szasz, L.; Brown, L. (Department of Physics, Fordham University, New York, New York 10458). J. Chem. Phys. 63: No. 10, 4560-4561 (15 Nov 1975).

A pseudopotential transformation for correlated-pair equations is derived that yields solutions that are pseudowavefunctions, i.e., they do not have to be orthogonal to the core functions. The approximate solutions for the transformation will be much simpler to compute, but they do not involve a loss of accuracy. (AIP)

10342 BOUNDARY CONDITIONS IN CLOSED UNIVERSE. Lawrence, J. K. (California State Univ., Northridge). Gen. Relativ. Gravitation; 6: No. 3, 253-258(Jun 1975).

The problem of a particle in a square potential well in a one-dimensional closed universe is considered. Imposition of periodic boundary conditions on the wave function changes the usual discrete energy levels to narrow but finite energy bands. Effects on the properties of atoms in a closed universe are estimated to be undetectable. (auth)

10343 VARIATIONAL PRINCIPLES FOR DISCONTINUOUS WAVE FUNCTIONS AND THE INDEPENDENT PARTICLE MODEL OF ELECTRONIC STRUCTURE. Ludena, E. V. (Instituto Venezolano de Investigaciones Cientificas, Caracas). Int. J. Quant. Chem.; 9: No. 6, 1069-1085(Nov 1975).

Using the variational method advanced by McCavert and Rudge, one obtains the independent particle model variational principle for loge localized discontinuous wave functions. The transformation of the variational expressions into matrix form when the loge localized discontinuous orbitals are expanded in finite basis sets is discussed. The simplifications brought about by this new method in the evaluation of molecular integrals are indicated. (auth)

10344 Z^{-1} PERTURBATION THEORY APPLIED TO THE CORRELATION ENERGY PROBLEM OF ATOMS. Robinson, B. H. Nashville; Vanderbilt Univ. (1975). 437p. University Microfilms Order No. 75-21,604.

Thesis (Ph. D.).

Rayleigh–Schroedinger Perturbation Theory is applied to obtain directly exact and explicit analytic formulas for the electron correlation energies of N electron systems in terms of their pairwise interactions through second order in Z^{-1}, where Z is the nucleus of the atom. It is demonstrated that the second order correlation energy may be expressed as exactly the sum of pairwise correlation energies. In the case of no zeroth order degeneracy, the zeroth and first order terms vanish. The expression for the pairwise energies is an infinite sum, all terms of which are of the same sign. There is no numerical differencing. In the case of zeroth order degeneracy it is shown that the above statement concerning the second order energy still holds, but the expressions are a bit more complicated. It is shown that they "almost" reduce to a much simpler form. Also, the computation of the first order correlation energy is considered. (Diss. Abstr. Int., B)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

Refer also to abstracts 8869 and 11176.

10345 (CONF-720133-P10, pp 97-101) RELATION BETWEEN SELF AVOIDING WALKS AND CRITICAL PHENOMENA. de Gennes, P. G. (College de France, Paris). 1972.

From 4th symposium on theoretical physics; Rio de Janeiro, Brazil (4 Jan 1972).

In IV Brazilian symposium on theoretical physics. Vol. X.

A relation between the counting of self-avoiding walks and the counting of the diagrams which occur in phase transitions is discussed; it is shown that, although it exists, such a relation is by no means an isomorphism. The starting point is a system of classical spins of unit length, each with n components, and coupled by short-range ferromagnetic interactions. n = 1 corresponds to the Ising problem, n = 2 is related to superfluid helium (where the order parameter has two independent components), and n = 3 is the Heisenberg case. 2 figures. (RWR)

10346 BOSE-EINSTEIN CONDENSATION IN A TWO-DIMENSIONAL SYSTEM AT CONSTANT PRESSURE. Chaba, A.N. (Departamento de Física, Universidade Federal da Paraíba, João Pessoa, Paraíba, Brazil); Pathria, R.K. Phys. Rev. B 12: No. 9, 3697-3704 (1 Nov 1975).

Using techniques developed by Greenspoon and Pathria, a rigorous, asymptotic analysis of the onset of Bose-Einstein condensation in a finite two-dimensional system at constant pressure is carried out. Some of the results obtained by Imry, Bergman, and Gunther, who first considered this problem, are upheld while others get modified. In particular, a macroscopic occupation of the single-particle ground state at finite temperatures is indeed possible. As the critical region, $T \simeq T_c$, is approached from above, the volume of the system becomes subextensive, $V_c = O\ (N/\ln N)$, which is both necessary and sufficient for the onset of Bose-Einstein condensation in the system. For instance, if the system is now cooled even at constant volume $V\ (= V_c)$, the condensate fraction gradually builds up and becomes nonnegligible as T approaches $T_0 \simeq (T_c)/2$; below T_0, it grows steadily as $(1 - T/T_0)$. On the other hand, if we continued to cool the system at constant P its volume, over a thermodynamically negligible range of temperatures, would reduce to values $O\ (N^{1/2})$ which, in turn, would be accompanied by an abrupt accumulation of practically all the particles of the system into the single-particle ground state ϵ_0. The specific heat C_P, after having passed through a maximum, would also finally reduce to subextensive values. Phase transitions of this kind may be of relevance to the physical behavior of thin helium films and helium submonolayers. (auth)

10347 MOMENTUM DISTRIBUTION IN A BOSE SOLID. Schwartz, M. (Tel Aviv University, Ramat Aviv, Israel). Phys. Rev. B 12: No. 9, 3725-3728 (1 Nov 1975).

The momentum distribution and possibility of Bose-Einstein condenstation in a Bose solid is discussed. It is shown that for a wide class of wave functions describing solids of general symmetries, Bose-Einstein condensation does not exist, provided the sum of certain normalized overlap integrals is less than 1. The realistic parameters of solid ^{4}He are such that the above condition is obeyed. (auth)

10348 APPLICATION OF FIELD-THEORETIC, COLLECTIVE-COORDINATE, AND CORRELATED-BASIS-FUNCTION METHODS TO MANY-BOSON SYSTEMS. Family, F. (Department of Physics, Clark University, Worcester, Massachsuetts 01610; Gould H. Phys. Rev. B 12: No. 9, 3729-3740 (1 Nov 1975).

The collective-coordinate and correlated-basis-function approaches are systematically applied to the determination of the elementary excitation spectrum $\omega\ (k)$ and the static structure function $S\ (k)$ for two models of a Bose gas which can be characterized by a single small expansion parameter g. Results are obtained to first order in g, the leading order in which multiexcitation processes are present, and are compared with those found by the microscopic-dielectric-function approach. It is found that a collective-coordinate calculation of $\omega\ (k)$ by Sunakawa, Yamasaki, and Kebukawa is incomplete to first order in g and that the convolution approximation for the three-particle distribution function in the correlated-basis-function formalism leads to incorrect results for overlap matrix element and for $S\ (k)$. A form for the overlap matrix element is proposed which leads to correct first-order results. Various properties of $\omega\ (k)$, $S\ (k)$, and the dynamic structure function are discussed. (auth)

10349 PHONON DISPERSION IN LIQUID He II. Meier, P.F. (Schweizerisches Institut für Nuklearforschung, CH-5234 Villigen, Switzerland); Beck, H.; Beck, R. Phys. Rev. B 12: No. 9, 3745-3748 (1 Nov 1975).

The eigenfunctions of the linearized collision operator for the phonons in superfluid helium are determined numerically. The calculated sound velocity is in quantitative agreement with experimental data in a wide frequency and temperature range if an anomalous dispersion $\gamma = -10^{38}$ in cgs units is used. (auth)

10350 NONEQUIVALENCE OF N-FIXED AND μ-FIXED FORMALISMS ADOPTING $a_0 = a_0 = N_0^{1/2}$ FOR CONDENSED BOSE SYSTEMS. Lee, J.C. (Department of Chemistry and Physics, Northwestern State University, Natchitoches, Louisiana 71457). Phys. Rev. B 12: No. 9, 3749-3754 (1 Nov 1975).

The idea of replacing the condensate operators by the c number $N_0^{1/2}$ in treating condensed Bose systems is known as Bogoliubov prescription (BP). Once BP is adopted, there are two ways to proceed. The first is the popular method of Hugenholtz and Pines, which we call μ-fixed formalism. The second may be found in the well-known works of Foldy and Brueckner on a dense charged boson gas. Unlike the μ-fixed formalism, the latter method does not require the introduction of the chemical potential, and thus it is called the N-fixed formalism. We argue that BP is rigorous in the μ-fixed formalism but is not in the N-fixed one. BP in the N-fixed one gives correct results for terms of leading orders (Foldy and Brueckner took just these terms) but incorrect results for terms of higher orders. (auth)

10351 DYNAMIC STRUCTURE FUNCTION OF A BOSE GAS AT $T = 0$. Bartley, D.L. (Department of Physics, Brown University, Providence, Rhode Island 02912); Wong, V.K. Phys. Rev. B 12: No. 9, 3775-3782 (1 Nov 1975).

The dynamic structure function $S\ (k,\omega)$, as a function of wave vector k and frequency ω, is calculated rigorously for a simple Bose gas at $T = 0$. The dielectric formulation is used to satisfy general symmetry requirements for a Bose system, and the calculation is carried out in the first approximation beyond Bogoliubov taking into account the three-phonon process. An analytic solution in terms of elliptic integrals is obtained for the width of $S\ (k,\omega)$ valid for arbitrary k and ω. Qualitatively, $S\ (k,\omega)$ at finite but small k is found to have a square-root behavior near the threshold frequency for two-phonon production, a peak at the elementary excitation frequency, and a long power-law tail at high frequencies. Illustrative numerical results are presented for the width of $S\ (k,\omega)$, the imaginary part of the phonon spectrum, and $S\ (k,\omega)$ itself. Finally, the impulse approximation and the extraction of the condensate density n_0 from $S\ (k,\omega)$ in the large-k limit are discussed. (auth)

PHYSICS (HIGH-ENERGY)

Particle Interactions and Properties (Experimental)

Refer also to abstracts 10424, 10438, and 10596.

10352 (UCLA-10-P25-33) ANNUAL PROGRESS REPORT TO U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION. Haddock, R. P.; Nefkens, B. M. K. (California Univ., Los Angeles (USA). Dept. of Physics). Oct 1975. Contract AT(11-1)-GEN-10. 25p. Dep. NTIS $3.50.

Experimental research on strong interactions is summarized. (JFP)

10353 SPS EXPERIMENTAL PROGRAM. Fidecaro, M. (CERN, Geneva). pp 191-218 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th rencontre de moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

The experimental program at the SPS is reviewed as it takes shape from the proposals put forward up to this Spring.

10354 INFORMATION FROM COSMIC RAYS ABOUT PARTICLE INTERACTIONS FROM 2×10^3 TO APPROX. 10^7 GeV. Gaisser, T. K. (Bartol Research Foundation of the Franklin Inst., Swarthmore, PA). pp 411-422 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th rencontre de moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

A brief survey is given of various types of cosmic ray experiment, the interaction energies probed by each and the limitations and problems of this approach to high energy physics. The goal is to provide a realistic assessment of the kind of information one can hope to obtain now from cosmic ray data about properties of particle interactions beyond ISR energies. (auth)

10355 PHYSICS AT HIGH TRANSVERSE MOMENTUM. Lederman, L. M. (Columbia Univ., New York). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 303-330(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The discussion of the observation of particles emitted with large momentum and at large angles from high energy collisions covers inclusive data, the nuclear target effect, correlations, and direct lepton observation. (JFP)

10356 HIGH ENERGY NUCLEAR REACTIONS IN OUR PLANETARY SYSTEM. Turkevich, A. L. (Univ. of Chicago). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 351-363(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Nuclear reactions of high energy particles with complex nuclei are occurring at significant rates in many parts of the solar system. The particles involved are galactic cosmic rays, solar flare particles, and radiation belt particles. The experimentally observable quantities are stable and radioactive products, gamma rays and neutrons. Most of these were used in investigations of the state and history of planetary system bodies, and may play an even larger role in future space missions. (auth)

Electromagnetic

Refer also to abstract 10627.

10357 (COO-535-733, pp 68-70) DOUBLE ELECTRON-POSITRON PAIR PRODUCTION BY LOW ENERGY GAMMA RAYS. Ristinen, R. A.; Peterson, R. J.; Cecil, F. E. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10358 (DESY-75/36) STUDY OF PHOTOPRODUCTION ON HYDROGEN IN A STREAMER CHAMBER WITH TAGGED PHOTONS FOR 1.6 GeV < E_γ < 6.3 GeV TOPOLOGICAL AND REACTION CROSS SECTIONS. Aachen-Hamburg-Heidelberg-Munchen Collaboration. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Sep 1975. 56p. Dep. NTIS (US Sales Only) $5.50.

Photoproduction was studied using a 1 m streamer chamber at DESY and a tagged photon beam with an energy range of 1.6 GeV < E_γ < 6.3 GeV. Approximately 30,000 events were analyzed, and topological, channel, and resonance production cross sections were reported for a large number of reactions with three and five outgoing charged particles. (auth)

10359 (RL-75-105) NEW UPPER LIMIT FOR THE BRANCHING RATIO FOR THE DECAY $\eta \to \pi^0 e^+ e^-$. Jane, M. R.; Grannis, P.; Jones, B. D. (Science Research Council, Chilton (UK). Rutherford Lab.). 1975. 9p. Dep NTIS (US Sales Only) $4.50.

A search was made for the decay $\eta \to \pi^0 e^+ e^-$ in an optical spark chamber experiment at the Rutherford Laboratory. The observations are consistent with no events being seen and give an upper limit Rate($n - {}^0e^+e^-$)/Rate(-ALL) 4.5×10^{-5} (90% C. L.) (auth)

10360 PRELIMINARY RESULTS ON HADRON PRODUCTION IN ELECTRON POSITRON COLLISIONS AT SPEAR. Lynch, H. L. (Stanford Linear Accelerator Center, CA). pp 139-160 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th rencontre de moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

Preliminary results are presented on the total hadronic cross section, charged multiplicities, inclusive spectra, and an exclusive channel, a four-pion final state. (auth)

10361 REMARKS ON e^+e^- ANNIHILATION. Smith, C. H. L. (CERN, Geneva). pp 161-179 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th rencontre de moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

A review is given of e^+e^- annihilation covering the main features of the data and their explanations, one-photon annihilation directly to hadrons, and a list of vital questions. (JFP)

10362 MEASUREMENT OF THE ELECTRON-DEUTERON ELASTIC SCATTERING CROSS SECTION IN THE RANGE 0.8 LESS THAN OR EQUAL TO q^2 LESS THAN OR EQUAL TO 6 GeV^2. Arnold, R. G. (American Univ., Washington, DC); Chertok, B. T.; Dally, E. B.; Grigorian, A.; Jordan, C. L.; Schuetz, W. P.; Zdarko, R.; Martin, F.; Mecking, B. A. AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 373-387(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Preliminary results of elastic ed scattering at large momentum transfer performed at the Stanford Linear Accelerator Center using two high resolution spectrometers in coincidence are reported. The deuteron structure function $A(q^2)$ at 9 values of q^2 is deduced from a comparison of elastic ed and ep coincident yields and the world's ep cross sections. These measurements extend the range of q^2 by 4.5 over previous work, and in this new range $A(q^2)$ is observed to approach $1/q^{29}$ momentum dependence. The results are in sharp disagreement with the meson exchange calculations, and they are in rough agreement with the nonrelativistic potential models, and they are in agreement with the predictions of the quark dimensional scaling model which pictures the deuteron as a bound state of 6 quarks at large momentum transfer. (auth)

10363 PRELIMINARY RESULTS OF RECENT THRESHOLD PION PHOTOPRODUCTION EXPERIMENTS ON NUCLEI. Deutsch, J. (Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium); Favart, D.; Prieels, R.; Van Oystaeyen, B.; Argan, P.; Audit, G.; Bloomquist, I.; de Botton, N.; Faure, J. L.; Schuhl, C.; Stoler, P.; Tamas, G.; Tzara, C. AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 445-447(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Preliminary results and proposed experiments on threshold pion photoproduction on nuclei are briefly described. These nuclei are lithium-6, helium-3, carbon-12, and nitrogen-14. (JFP)

10364 INELASTIC omega PHOTOPRODUCTION AT 9.75 GeV/c. Abramson, J. J. Rochester, NY; Univ. of Rochester (1975). 147p. University Microfilms Order No. 75-22,721.

Thesis (Ph. D.).

The omega photoproduction of hydrogen and deuterium with an incident photon beam tagged between 7.37 GeV/c and 8.78 GeV/c. By measuring the four momentum of the three pions from the

decay of the omega(omega yields pi⁺pi⁻pi⁰) one can reconstruct the omega four-momentum and the four-momentum of the recoiling nucleon. Differential and total cross sections for the reactions are measured. The spin density matrix elements are presented as a function of parallel bar t-t/sub min/parallel bar. A simple absorption model describes the spin density matrix elements better than pure t-channel helicity conservation. The invariant structure function, F(x'), where x' is Feynman's scaling variable, is presented and compared with two other inclusive reactions. (Diss. Abstr. Int., B)

10365 BHABHA SCATTERING AT 2.6 GeV. Simpson, J. W. Jr. Stanford CA; Stanford Univ. (1975). 161p. University Microfilms Order No. 75-25,607.

Thesis (Ph. D.).

The results of a measurement of the electron-electron elastic scattering (Bhabha) reaction at angles close to 90 degrees, relative to the same reaction at 3.7 degrees, are reported at a center of mass energy equal to 5.2 GeV. The 930 large angle events observed were detected in two spectrometers, each of which consisted of three 25 x 25 inch multiwire proportional chambers and a large sodium iodide total absorption shower counter. A 2 percent measurement of the number of small angle events was accomplished through the use of a combination of four plastic and lead plastic sandwich telescope counters which formed the luminosity monitor. The results are found to be consistent with the predictions of quantum electrodynamics. (Diss. Abstr. Int., B)

Weak

Refer also to abstract 10445.

10366 (JINR-P1-9231) SEARCH FOR $\pi^+ \to e^+ + \nu_e + e^+ + e^-$ DECAY. Korenchenko, S. M.; Kostin, B. F.; Mitsel'makher, G. V.; Nekrasov, K. G.; Smirnov, V. S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 9p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The search for the $\pi^+ \to e^+ + \nu_e + e^+ + e^-$ decay was carried out with the help of a magnetic spark spectrometer. It was found that $W(\pi^+ \to e^+ + \nu_e + e^+ + e^-)/W(\pi^+ \to \mu^+ + \nu_\mu) \leq 5 \cdot 10^{-9}$ with 90% confidence level under the assumption of the constant matrix element of the process. (auth)

10367 TESTS OF SCALE INVARIANCE IN THE GARGAMELLE NEUTRINO: EXPERIMENT. Degrange, B. (Ecole Polytechnique, Paris). pp 51-74 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th rencontre de moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

The neutrino experiment performed with the CERN $\nu/\bar{\nu}$ beam in the large heavy liquid bubble chamber "Gargamelle" has yielded results in agreement with scale invariance predictions in the energy range 1 to 10 GeV. The signification of this "precocious" scaling is analyzed through the study of the distributions of the scaling variables $x' = q^2/(2M\nu + M^2)$, and of the variable $y = \nu/E$, in a sample of 2600 ν events and 1000 $\bar{\nu}$ events. (auth)

10368 RECENT RESULTS ON ν, $\bar{\nu}$ CHARGED CURRENT INTERACTIONS AT NAL. Aubert, B.; Benvenuti, A.; Cline, D.; Ford, W. T.; Imlay, R.; Ling, T. Y.; Mann, A. X.; Messing, F.; Piccioni, R. L.; Pilcher, J.; Reeder, D. D.; Rubbia, C.; Stefanski, R.; Sulak, L. (Harvard Univ., Cambridge, MA). pp 75-86 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th rencontre de moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

The dependence of the ν cross section on energy was measured to 160 GeV. The ratio $\sigma_{\bar{\nu}}/\sigma_\nu$ is measured to 70 GeV. Preliminary results are presented for the distributions of the scaling variables x, y observed in neutrino induced events. (auth)

10369 NEUTRAL CURRENTS IN GARGAMELLE. Kluberg, L. (Ecole Polytechnique, Paris). pp 111-124 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th rencontre de moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

The latest status of the research of neutral currents in the well known Gargamelle bubble chamber, experiment which is still going on, is presented. An attempt was made to collect the latest data from each one of the seven laboratories of the so-called Gargamelle collaboration, and some rough calculations were done. So the approximative numbers given for the leptonic neutral currents do not bind the collaboration. (auth)

10370 K/sub S/-REGENERATION: AN INTERPLAY OF NUCLEAR AND PARTICLE PHYSICS. Telegdi, V. L. (Univ. of Chicago). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 289-302 (1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The usefulness of K/sub S/-regeneration on nuclear targets for either nuclear or particle physics is illustrated by several examples. Old as well as new high energy experiments related to this topic are discussed. (auth)

10371 NEGATIVE MUON SPIN ROTATION EXPERIMENT. Yamazaki, T.; Nagamine, K.; Nagamiya, S.; Hashimoto, O. (Univ., Tokyo). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 587-597(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Results of the experimental project using negative muon spin rotation at Lawrence Berkeley Laboratory are reported. The following were discussed briefly: the bound muon g factors from the viewpoints of the relativistic and nuclear polarization effects, strange depolarization phenomena in terms of the difference between the muonic-atom probe and its equivalent nuclear probe, application of mu⁻0 probe to studies of magnetic oxides, and total muon capture rates in the actinide region. (auth)

Strong (Baryon-induced)

Refer also to abstracts 10493, 10518, 10542, 10557, 10631, 10632, 10967, and 11093.

10372 (CRN/HE-75-2) ANALYSIS OF TWO-PRONG EVENTS IN ANTIPROTON-PROTON INTERACTIONS AT 5.7 GeV/c. Braun, H.; Gerber, J. P.; Maurer, G.; Michalon, A.; Schiby, B.; Strub, R.; Chew-Mettel, B.; Ouannes, C.; Strachman, Z. (Centre National de la Recherche Scientifique, 67-Strasbourg (France). Centre de Recherches Nucleaires). 1975. 45p. INIS.

A study of elastic scattering, one pion production and annihilation reactions in $\bar{p}p$ interactions at 5.7 GeV/c was carried out, from the two prong events, obtained in the hydrogen bubble chamber exposed at CERN. Single particle distributions for the reactions $\bar{p}p \to \bar{p}p\pi^0$, $\bar{p}p \to \bar{p}n\pi^+$ and $\bar{p}p \to p\bar{n}\pi^-$ are presented. The study of the squared momentum transfer distributions with and without charge exchange in the cross channel shows different behavior of the slope parameters versus the mass of the produced ($N\pi$) system. The cross sections for isobar production and for diffractive dissociation in the one pion production reactions are obtained from a detailed Dalitz plot analysis. The results of the analysis of the decay angular distributions for the N (1510) and for the N (1680) produced in these reactions are in agreement with J = 3/2 and J = 5/2 assignment, respectively. The cross sections of the annihilation reactions $\bar{p}p \to \pi^+\pi^-$ and $\bar{p}p \to \pi^+\pi^-\pi^0$ are determined. Finally, some aspects of the mass distributions for the last reaction are given. (FR)

10373 (ISN-T-75-01) MEASUREMENTS OF THE SPIN CORRELATION COEFFICIENTS C_{xx}, C_{yy}, AND S FOR d-p SCATTERING AT LOW ENERGY. Chauvin, J. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Grenoble-1 Univ., 38 (France)). 1975. 217p. (In French). INIS.

Thesis.

The spin correlation coefficients $C_{(xx)}$, $C_{(yy)}$ and S have been measured for deuteron-proton elastic scattering at different angles and at four deuteron beam energies: 26, 23.8, 19.5, and 17.4 MeV. Measurements were performed at the Grenoble cyclotron by scattering the vector and tensor polarized deuteron beam from a polarized proton target. The spin correlation coefficients are sensitive to the trinucleon spin doublet states in which two nucleon short range effects or eventual three body forces are expected. But only Faddeev calculations with realistic nucleon-nucleon potentials will confirm if such effects are necessary to reproduce the doublet scattering states. (FR)

10374 (LNF-75/27(R)) LARGE MOMENTUM TRANSFER PHENOMENA. Bellettini, G. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati). 22 May 1975. 31p. Dep. NTIS (US Sales Only) $5.00.

An experimental review is given on single hadron and lepton production at large momentum transfer in hadron-hadron collisions and on associated-particle correlations. (46 figures) (auth)

10375 (LPNHEX-T-74-03) $\bar{p}p$ ELASTIC SCATTERING IN THE BACKWARD HEMISPHERE AT LOW MOMENTUM (BETWEEN 175 AND 750 MeV/c IN THE LABORATORY SYSTEM). Evidences in Favor of an Occurrence of the S Meson with $J^{PC} = 4^{++}$. Laloum,

M. (Ecole Polytechnique, 75 – Paris (France). Lab. de Physique des Hautes Energies; Paris-11 Univ., 91 – Orsay (France)). 1974. 152 p. (In French). INIS.

Thesis.

Description is given of an $\bar{p}p$ backward elastic scattering experiment between 175 and 750 MeV/c ($\cos\theta$ (CM) ≤ +0.2 above 300 MeV/c). Various methods are developed for kinematical analysis of events and for normalization of cross sections in a continuum of energy. A pronounced enhancement appears in the extreme backward direction between ~400 and 600 MeV/c: its great angular stability and its characteristic energy behavior strongly argue for a resonant nature. Analysis clearly suggests $J^{PC} = 4^{++}$ well connected with other experimental results with I = 1. All quantum numbers are then obtained, $(J^P I^G)_C = (4^+1^-)_+$; they coincide with the expected values for the S meson on the linearly extended A2 trajectory. An observed mass splitting also agrees with some theoretical predictions. A partial-waves analysis performed at 400 and 500 MeV/c brings no decisive elements about the origin of the structure. (FR)

10376 (ORO-3956-3) BUBBLE CHAMBER STUDIES OF HADRON AND PHOTON INTERACTIONS. Progress Report, June 1, 1972–May 31, 1973. Bugg, W. M.; Condo, G. T.; Hart, E. L. (Tennessee Univ., Knoxville (USA)). 1973. Contract AT(40-1)-3956. 12p. Dep. NTIS $3.50.

Experimental research on strong interactions is summarized. (JFP)

10377 HADRON PHYSICS AT ISR ENERGIES. Jacob, M. (European Organization for Nuclear Research, Geneva (Switzerland)). pp 389-444 of Trends in Elementary Particle Theory. Rollnik, H.; Dietz, K. (eds.) (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Berlin; Springer (1975).

23 figs.; 1 tab.; 34 refs.

The results of proton-proton colliding beam experiments in 1974 are reviewed. The rise of the total cross-section over the 250–2,000 GeV range, the shape of the proton, the question of scaling, the diffractive excitation and large transverse momentum phenomena are discussed in detail. (GE)

10378 SPIN EFFECTS IN PROTON–PROTON SCATTERING. Krisch, A. D. (Univ. of Michigan). pp 103-112 of Proceedings of the Ninth Recontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

An experiment was done using a polarized proton beam and a polarized proton target. The cross section for elastic proton–proton scattering at 6 GeV/c and P^2/sub perpendicular to/ equals 0.5 yields 1.6 $(GeV/c)^2$ was measured in several spin states. The cross sections were found to be unequal by up to a factor of 2. The significance of this spin dependence is discussed along with future plans. (auth)

10379 SMALL ANGLE PROTON SCATTERING FROM 8 TO 400 GeV. Olsen, S. L. (Univ. of Rochester, NY). pp 219-234 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th rencontre de moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

Small-angle pp scattering was measured at NAL. The slope parameter b(s) and also the ratio of the real to imaginary parts of the forward scattering amplitude at energies up to 400 GeV were determined. The results are consistent with local field theory only if the pp total cross section rises through the ISR energy range. (auth)

10380 INCLUSIVE REACTION pp = pX AT THE CERN ISR. Strolin, P.; Albrow, M. G. (CERN, Geneva). pp 237-248 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th rencontre de moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

Experiments at the CERN ISR have given evidence for proton single-dissociation processes where the missing mass of the system X, measured on the proton which is observed in the reaction p + p → p + X, presents a distribution extending up to large values, in the 10 GeV range. These processes globally account for ~15% of the inelastic p-p cross section. Evidence for such a distinct class of inelastic phenomena is also provided by long-range rapidity correlations and clustering. The nature of these processes appears to be predominantly diffractive. The physics which emerges from ISR observations is discussed, together with a presentation of present and planned lines of experimental investigation at the ISR. (auth)

10381 TRIPLE REGGE ANALYSIS OF pp → pX. Roberts, R. G. (Rutherford Lab., Chilton, Eng.). pp 261-268 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th rencontre de moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

All existing data on pp → pX were analyzed and the PPP and PPM terms obtained. The PPP term is dominant and, taking into account double diffractive dissociation, gives rise to an increase in the total cross section of 3.3 mb from 200 to 2000 GeV/c. A prediction is given for the size of the double-Pomeron cross section at 300 GeV/c. (auth)

10382 DIFFRACTIVE COMPONENT IN pp INTERACTIONS AS SEEN IN THE NAL BUBBLE CHAMBER. Vander Velde, J. (Univ. of Michigan, Ann Arbor). pp 403-410 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th rencontre de moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

Experimental evidence is reviewed on the diffractive inelastic component seen in the NAL 30-inch hydrogen chamber at 102, 205 and 405 GeV/c. The integrated cross section $d\sigma/dM^2$ appears to have an s-independent low mass peak for $M^2 \cong 10$ GeV^2. The data do not support a dominant triple-Pomeron term for the cross section in the range $.90 < x < .99$. (auth)

10383 SOME COMPARISONS OF HIGH-ENERGY pp AND πp INTERACTIONS. Trilling, G. H. (Univ. of California, Berkeley). pp 423-433 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th rencontre de moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

Comparisons of pp and πp interactions at 205 GeV/c incident laboratory momentum are presented. Most features of the inelastic processes are remarkably similar. (auth)

10384 OBSERVATION OF THE PHASE SHIFT OF A NEUTRON DUE TO PRECESSION IN A MAGNETIC FIELD. Werner, S.A. (Physics Department, University of Missouri, Columbia, Missouri 65201); Colella, R.; Overhauser, A.W.; Eagen, C.F. Phys. Rev. Lett. 35: No. 16, 1053-1055 (20 Oct 1975).

We have directly observed the sign reversal of the wave function of a fermion produced by its precession of 2π radians in a magnetic field using a neutron interferometer. (auth)

10385 STUDY OF THE REACTION $p+p \to \Delta^{++}(1236)+X^0$ AT 205 GeV/c. Barish, S.J.; Derrick, M.; Musgrave, B.; Schultz, P. (Argonne National Laboratory, Argonne, Illinois 60439); Whitmore, J.; Engelmann, R.; Kafka, T.; Pratap, M.; Field, R.D. Phys. Rev. D 12: No. 5, 1260-1271 (1 Sept 1975).

We have studied inclusive $\Delta^{++}(1236)$ production for $|t_{p\Delta}| < 1.0$ $(GeV/c)^2$ in a 50 000 picture exposure of the 30-inch hydrogen bubble chamber to a 205 GeV/c proton beam. The inclusive Δ^{++} cross section for one hemisphere in the center-of-mass system is (1.30 ± 0.14) mb. The mean charged multiplicity of the system recoiling off the Δ^{++} is in agreement with that for laboratory $\pi^- p$ interactions at the same energy in the center-of-mass frame. The inclusive Δ^{++} production is compared to inclusive Δ^0 and proton production in the same experiment. The connection between Δ^{++} production and diffraction is discussed. We find that not all Δ^{++} come from the decay of a diffractively-produced state. The P_T^2 distribution for the Δ^{++} has a slope of (10.5 ± 0.9) $(GeV/c)^{-2}$ for $P_T^2 \lesssim 0.2$ $(GeV/c)^2$. This slope, together with the decay angular distribution of the Δ^{++} at small momentum transfer, suggests a strong pion-exchange contribution to the inclusive process. We compare the data to the expectation of a triple-Regge model with ρ- and π-exchange contributions. (auth)

10386 NEGATIVE-HYPERON PRODUCTION IN HIGH-ENERGY PROTON INTERACTIONS. Hungerbühler, V.; Majka, R.; Marx, J.N.; Némethy, P.; Sandweiss, J.; Tanenbaum, W.; Willis, W.J. (Yale University, New Haven, Connecticut 06520); Atac, M.; Ecklund, S.; Gollon, P.J.; Lach, J.; MacLachlan, J.; Roberts, A.; Stefanski, R.; Theriot, D.; Wang, C.L. Phys. Rev. D 12: No. 5, 1203-1210 (1 Sept 1975).

Momentum spectra for forward Σ^- and Ξ^- production by protons on beryllium are presented. Σ^- production data for two primary proton momenta are compared to test scaling of the invariant cross section. In addition, the observed single-particle momentum distributions are compared with single-particle spectra from other inclusive reactions initiated by protons. (auth)

10387 SOME FEATURES OF THE REACTION $pp \to \Delta^{++}(1236)n$ AT 6 GeV/c. Mountz, J.D.; Smith, G.A. (Department of Physics, Michigan State University, East Lansing, Michigan 48824); Lennox, A.J.; Poirier, J.A.; Prukop, J.P.; Rey, C.A.; Sander, O.R.; Kirk, P.; Klem, R.D.; Spirn, I. Phys. Rev. D 12: No. 5, 1211-1218 (1 Sept 1975).

Approximately 12 000 examples of the reaction $pp \rightarrow \Delta^{++}(1236)\, n$ have been identified at 6 GeV/c in a spark-chamber experiment performed at the Argonne National Laboratory Zero Gradient Synchrotron. The experimental invariant-mass and momentum-transfer-squared distributions are in agreement with predictions of the Chew-Low one-pion-exchange model, suitably modified to account for form factors or absorption. The data have been extrapolated from the physical region to the pion pole. It is found that the Dürr-Pilkuhn and Benecke-Dürr models, in conjunction with quadratic extrapolations in t, reproduce the known on-mass-shell dependence of the cross section for the elastic $\pi^+ p$ scattering. (auth)

10388 CHARGED-PARTICLE MULTIPLICITY DISTRIBUTION IN *pd* INTERACTIONS AT 300 GeV/c. Sheng, A.; Firestone, A.; Peck, C. (California Institute of Technology, Pasadena, California 91125); Dzierba, A.; Anderson, E.W.; Crawley, H.B.; Kernan, W.J.; Canter, J.; Dao, F.T.; Mann, A.; Schneps, J.; Poucher, J.; Stone, S. Phys. Rev. D 12: No. 5, 1219-1223 (1 Sept 1975).

Charged-particle multiplicity distributions in 300-GeV/c pd interactions have been determined from an exposure of the Fermi National Accelerator Laboratory 30-in. bubble chamber. The data show clear evidence for double scattering inside the deuterium nucleus. We have been able to correct for the effects of the second scatters using a simple semiempirical model. The resulting pp multiplicity distribution is in excellent agreement with the pp data obtained from a p-H_2 experiment at the same energy. The pn multiplicity distribution appears to be shifted from the pp distribution with $\langle n_c \rangle_{pn} = 7.84 \pm 0.17$. (auth)

10389 CHARGE STRUCTURE OF MULTIPARTICLE FINAL STATES IN *pp* COLLISIONS AT 102 AND 400 GeV/c. Bromberg, C.; Chaney, D.; Ferbel, T.; Jensen, T.; Schindler, R.; Slattery, P.; Weingarten, D. (University of Rochester, Rochester, New York 14627); Seidl, A.A.; VanderVelde, J.C. Phys. Rev. D 12: No. 5, 1224-1231 (1 Sept 1975).

We investigate the distribution of charge in events produced by pp collisions at 102 and 400 GeV/c. The data are from exposures of the Fermi National Accelerator Laboratory 30-in. bubble chamber. A comparison of the energy dependence of the data with Monte Carlo simulations of random charge distributions provides support for the hypothesis of local compensation of charge. Results on charge transfer are in qualitative agreement with predictions of an independent neutral-cluster emission model. (auth)

10390 MEASUREMENTS OF THE MAGNETIC DIPOLE MOMENTS OF THE ANTIPROTON AND THE Σ^- HYPERON. Roberts, B.L.; Cox, C.R.; Eckhause, M.; Kane, J.R.; Welsh, R.E. (College of William and Mary, Williamsburg, Virginia 23185); Jenkins, D.A.; Lam, W.C.; Barnes, P.D.; Eisenstein, R.A.; Miller, J.; Sutton, R.B.; Kunselman, A.R.; Powers, R.J.; Fox, J.D. Phys. Rev. D 12: No. 5, 1232-1246 (1 Sept 1975).

The fine-structure splittings in atoms formed by stopping antiprotons in Pb and U and Σ^- hyperons in Pb and Pt have been measured. Since the fine structure is produced through the interaction of the magnetic dipole moment of the $\bar{p}$ or the Σ^- with the Coulomb field of the nucleus, a value for the magnetic moment can be determined from the splitting. The magnetic moment obtained for the $\bar{p}$ was (-2.819 ± 0.056) nuclear magnetons, which agrees well with the *CPT* prediction of -2.793 nuclear magnetons. The magnetic moment derived for the Σ^- was (-1.48 ± 0.37) nuclear magnetons, which is in agreement with the sign given by simple SU(3) theory, but differs somewhat from the value of -0.9 nuclear magnetons predicted by the theory with no mass breaking. (auth)

10391 PION PRODUCTION IN NUCLEON–NUCLEON COLLISIONS. Stephenson, G. J. (Los Alamos Scientific Lab., NM). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 55-62(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

An idea of the quality of the data on pion production in N–N interactions is given, and attention is called to some regularities. (JFP)

10392 HYPERNUCLEAR SYSTEMS AND HYPERON–NUCLEUS INTERACTION. Povh, B. (Max-Planck-Institut fuer Kernphysik, Heidelberg). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 173-183 (1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

A review of counter experiments on hypernuclei is given. The experimental techniques used in these experiments together with the results on light hypernuclei are summarized. (auth)

10393 HEAVY ION INTERACTIONS AT HIGH ENERGIES. Baldin, A. M. (Joint Inst. for Nuclear Research, Dubna, USSR). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 621-641(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

A review is given mainly on the results of research carried out at JINR, Dubna. Special attention will be given to one-particle inclusive processes, which occur when relativistic nuclei interact, since more complicated processes are not studied well enough at present. In addition, a short review is given of the program of research with relativistic nuclei at the Laboratory of High Energies, JINR. (auth)

10394 ANGULAR DISTRIBUTION CHARACTERISTICS OF SECONDARY PARTICLES FROM INELASTIC pN-COLLISIONS AT 200 Gev/c. Azimov, S. A.; Bondarenko, A. I.; Gulamov, K. G.; Navotnyi, V. Sh.; Petrov, V. I.; Riskiev, T. T.; Trofimova, T. P.; Chernova, L. P.; Chernov, G. M. (Physical-Technical Inst., Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 6, 38-44(1974). (In Russian)

A study is made of the main characteristics of angular distributions form of the distribution, anisotropy, asymmetry and inhomogeneity in overall showers and in individual events of proton-proton and proton-neutron collisions at 200 Gev/c. A comparison is carried out with various models for multiple particle generation. (tr-auth)

10395 ANALYSIS OF TWO-PRONG EVENTS IN ANTIPROTON PROTON INTERACTIONS AT 5.7 GeV/c. Braun, H.; Gerber, J.-P.; Maurer, G.; Michalon, A.; Schiby, B.; Strub, R. (Strasbourg-1 Univ., 67 (France)); Chew, D. M.; Quannes, C.; Strachman, Z. (Paris-6 Univ., 75 (France). Lab. de Physique Nucleaire et de Hautes Energies). Nucl. Phys., B; 95: No. 3, 481-502(8 Sep 1975).

A study of elastic scattering, one-pion production and annihilation reactions in anti pp interactions at 5.7 GeV/c was carried out, from the two-prong events, obtained in the hydrogen bubble chamber exposed at CERN. Single particle distribution for the reactions anti $pp \rightarrow pp\pi^0$, anti $pp \rightarrow$ anti $pn\pi^+$ and anti $pp \rightarrow$ anti $pn\pi^-$ are presented. The study of the squared momentum transfer distribution with and without charge exchange in the cross channel shows different behavior of the slope parameters versus the mass of the produced ($N\pi$) system. The cross sections for isobar production and for diffractive dissociation in the one-pion production reactions are obtained from a detailed Dalitz plot analysis. The results of the analysis of the decay angular distribution for the N(1510) and for the N(1680) produced in these reactions are in agreement with $J = 3/2$ and $J = 5/2$ assignment, respectively. The cross sections of the annihilation reactions anti $pp \rightarrow \pi^+\pi^-$ and anti $pp \rightarrow \pi^+\pi^-\pi^0$ are determined. Finally, some aspects of the mass distributions for the last reaction are given. (NL)

10396 IS THERE RESONANCE IN THE Λ ANTI Λ SYSTEM. Barkov, B. P.; Bolonkin, B. V.; Baloshin, O. N. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 22: No. 1, 223-224(Jul 1975). (In Russian)

In a study of the formation of strange particles in π^-p reactions at 40 and 50 GeV/c, a search was made for the existence of a resonance in the $\pi^-p \rightarrow \Lambda\bar{\Lambda}n$ reaction. The 75 events observed of this reaction were analyzed with respect to their effective mass distribution, and the results indicated the existence of resonances in the mass region $2.23 < m_{\Lambda\bar{\Lambda}} < 2.7$ GeV. There is a possible resonance in the mass region from 3.38 to 3.50 GeV. (JSR)

Strong (Meson-induced)

Refer also to abstracts 9374, 10500, and 10519.

10397 (CEA-N-1801) STUDY OF $K^-n \rightarrow Y\pi^-$ REACTIONS AT 3 GeV/c. Scheuer, J. C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires; Paris-11 Univ., 91 – Orsay (France)). May 1975. 163p. (In French). INIS.

The total and differential cross sections of the reactions $K^-n \rightarrow Y\pi^-$ were determined at 3 GeV/c for nine $S = -1$ baryonic states. Backward peaks associated with a dip near $u = -0.2$ are observed in many cases. They were interpreted for the isospin zero, Y states in terms of the proton exchange mechanism. The backward peaks in the reactions $K^-n \rightarrow A\pi^-$ and $K^-n \rightarrow \Sigma^0\pi^-$ are more quantitatively related to the backward $\pi N \rightarrow N\pi$ differential cross sections at the same energy. (FR)

10398 (CONF-750869-1) SEARCH FOR CHARM IN 250 GeV/c π^-p INTERACTIONS. Harris, R.; Bogert, D.; Hanft, R. (Fermi National Accelerator Lab., Batavia, Ill. (USA); Florida State Univ., Tallahassee (USA)). 1975. 12p. Dep. NTIS $4.50.

From division of particle and fields meeting; Seattle, Washington, USA (Aug 1975).

Inclusive cross sections are found for strange particle production in π^-p interactions at 250 GeV/c in a search for charmed

particles using neutral particle decays in a bubble chamber. The results are preliminary, but at the present statistical level no evidence was found for charmed particle production. (JFP)

10399 (FRNC-TH-530) K^-p INTERACTION AT 2 GeV/c. Baccari, B. (Paris-6 Univ., 75 (France)). 1971. vp. (In French). INIS.

Thesis.

Preliminary results on two-body reactions are presented. For the $\pi^+\Sigma^+$, $\bar{K}^0N$, and $\Lambda\pi^0$ channels, the number of events studied was lower than 10% of the total number of events. Total cross sections are given. For the elastic scattering, about 2% of the total number of events were concerned. The elastic cross section was determined. The angular distributions were expanded into Legendre polynomial series and the values of A_1 obtained are compatible with those obtained by Daum et al. using a higher number of events in the same energy range. The kaon-nucleon elastic scattering was analyzed in terms of Regge pole exchanges. The preliminary results of this analysis are in agreement with the differential cross sections obtained. (FR)

10400 (FRNC-TH-532) STUDY OF THE $K^+p \to K^{+0}p\pi^{0+}$ REACTIONS BETWEEN 2.1 AND 2.7 GeV/c. Brunet, J. M. (Paris-6 Univ., 75 (France)). 1971. vp. (In French). INIS.

Thesis.

$K^+p \to K\pi N$ reactions were studied at 2.11, 2.31, 2.53, and 2.72 GeV/c, special attention being given to the $K^+p \to K^0\pi^+p$ and $K^+p \to K^+\pi^0p$ channels. The production of K*(892) and $\Delta^{++}(1236)$ resonances, very frequent in these two reactions, was studied in terms of a simple Regge model. It was possible, by including results of other experiments at near energies, to establish the dominance of the vector meson exchange. This result is confirmed by the study of the angular distributions in the decay of these resonances, and the determination of the corresponding density matrix elements. The relations predicted by the quark model for these reactions was also tested. (FR)

10401 (JINR-P1-9177) INVESTIGATION OF THE CHARGED PARTICLE MULTIPLICITY IN THE FORWARD AND BACKWARD HEMISPHERES IN π^-p- AND π^-n- INTERACTIONS AT 40 GeV/c. Kladnitskaya, E. N.; Mihul, A.; Sood, P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The results of the charged particle multiplicity investigation in the forward and backward hemispheres in the c.m.s. for π^-p- and π^-n- interactions at 40 GeV/c are presented. The multiplicity distributions are the same for π^-p- and π^-n- interactions in the forward hemisphere and they are different in the target hemisphere. The positive forward-backward multiplicity correlation was observed which is the same for π^-p- and π^-n- interactions. (auth)

10402 (JINR-P1-9207) CHARGED PARTICLE WITH γ-QUANTUM CORRELATIONS IN π^-N INTERACTIONS AT P = 40 GeV/c. Angelov, N.; Vishnevskaya, K. P.; Grishin, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The experimental data are presented on investigation of two-particle correlations $R(y_1^+, y_2^+)$, $C(y_1^+, y_2^+)$ on rapidity for (ych), ($\gamma\gamma$) systems in π^-p interactions at 40 GeV/c. The obtained results are compared with the two-particle correlations in (ch ch)-system. For the first time there were obtained the R- and C-functions for $(\gamma\pi^-)$ and $(\gamma\pi^+)$ systems. The analysis of the experimental data has shown that for (ych) and ($\gamma\gamma$) systems there were observed the short-range positive correlations and the ratio $R_{chch} > R_{ych} > R_{\gamma\gamma}$ took place. The study of the azimuthal correlations allowed one to observe the correlations connected to the identical particles for ($\gamma\gamma$) and ($\pi^-\pi^-$) systems. The obtained results were compared with calculations over the multiperipheral model and the phase volume. The model gives a satisfactory description of the experimental data. (auth)

10403 (JINR-P1-9208) CHARGE ASYMMETRY IN π^-p INTERACTIONS AT 40 GeV/c AND QUARK MODEL. Grishin, V. G.; Kladnitskaya, E. N.; Mel'nikova, N. N.; Sud, P. M.; Shekhter, V. M.; Shcheglova, L. M.; Yancho, G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The asymmetry in the spectra of charged particles $d\sigma_\pm/dx$ in the c.m.s. as well as the forward-backward charge asymmetry were studied in π^-p interactions at 40 GeV/c. The results are discussed from the point of view of the quark model. (auth)

10404 (JINR-P1-9209) STUDY OF π^-n AND π^-C^{12} INTERACTIONS INVOLVING STRANGE PARTICLES AT THE MOMENTUM OF 40 GeV/c. Angelov, N.; Vishnevskaya, K. P.; Grishin, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 25p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The inclusive and semi-inclusive cross sections of Λ- and K^0-particle production in π^-n and π^-C^{12}-interactions at 40 GeV/c were determined. There was not observed the correlation between the mean number of Λ-hyperons and the number of charged particles in π^-n and π^-C^{12}-events as well as between $\langle n_{K^0}\rangle$ and n in π^-n events. For π^-C^{12} interactions a tendency was observed to the increase of $\langle n_{K^0}\rangle$ with the increase of n. In π^-C^{12} interactions there was produced, on the average, the same quantity of Λ and K^0-particles as in the interactions of π^--mesons with nucleons. (auth)

10405 (LBL-4610) MEASUREMENT OF THE π^-p YIELDS π^0n AND π^-p YIELDS eta n DIFFERENTIAL CROSS SECTIONS AT BEAM MOMENTA FROM 20 TO 200 GeV/c. Johnson, R. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nov 1975. Contract W-7405-ENG-48. 97p. Dep. NTIS $6.00.

Thesis.

The results of a measurement of the π^-p yields π^0n and π^-p yields eta n differential cross sections at six pion beam momenta from 20 to 200 GeV/c are presented. The data for these cross sections were collected at the Fermi National Accelerator Laboratory in Batavia, Illinois. A 73.5 x 73.5 cm lead-scintillator hodoscope was used to detect the two photons from the decay of the π^0 and the eta; all other reactions were eliminated by detection of their charged particles and additional photons in an array of veto counters. The zero-degree charge exchange cross sections determined from these measurements are shown to be consistent with the measured π^+p and π^-p total cross section differences. Effective Regge trajectories for the rho and the A_2 are also extracted from the data. 34 figures, 9 tables. (auth)

10406 POLARIZATION AND SPIN ROTATION MEASUREMENTS IN π^-p AND K^-p ELASTIC SCATTERING AT 4π GeV/c. Ducros, Y. (CEN de Saclay, Gif-sur-Yvette, France). pp 137-146 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th rencontre de moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

The polarization parameter P_o and the spin rotation parameter R were measured at Serpukhov in π^-p and K^-p elastic scattering at 40 GeV/c. These measurements show a decreasing of P_o compatible with a Regge model. The helicity flip amplitude in the Pomeron exchange is of the order of ten percent of the non-flip amplitude. (auth)

10407 MEASUREMENT OF THE K_L^0-p AND K_L^0-d TOTAL CROSS SECTIONS. Cleland, W.E.; Goz, B.; Freytag, D. (Department of Physics and Astronomy, University of Massachusetts, Amherst, Massachusetts 01002); Devlin, T.J.; Esterling, R.J.; Vosburgh, K.G. Phys. Rev. D 12: No. 5, 1247-1259 (1 Sept 1975).

Total cross sections have been measured for the transmission of long-lived neutral K mesons through hydrogen and deuterium. The momentum range for the K_L^0 was 130-550 MeV/c. The momentum of each detected kaon was measured by time of flight. The cross sections are consistent with earlier less precise results. Comparison of the K_L^0 cross sections is made with the results of several K-matrix fits to other $\bar{K}N$ data, and the K_L^0 total cross sections are compared with existing theoretical calculations for K-d total cross sections. (auth)

10408 FEATURES OF THE $\pi^+d \to \pi^+\pi^+\pi^-d$ REACTION AT 6 GeV/c. Diaz, J.; DiBianca, F.A.; Fickinger, W.J.; Malko, J.A.; Robinson, D.K. (Case Western Reserve University, Cleveland, Ohio 44106); Dado, S.; Engler, A.; Keyes, G.; Kraemer, R.W. Phys. Rev. D 12: No. 5, 1272-1277 (1 Sept 1975).

We have studied the coherent $\pi^+d \to \pi^+\pi^+\pi^-d$ reaction using a sample of 4019 events having a visible final-state deuteron. The total cross section, corrected for invisible deuteron events, was found to be 380 ± 50 μb. The main features of the data are the large production ρ^0 (90%), with a corresponding $\rho^0\pi^+$ enhancement in the A_1 region, and the observation of the $d\pi$ enhancement at $\sim$2.2 GeV. (auth)

10409 STUDY OF THE REACTION $\pi^- + d \to p + \pi^- + n$ WITH LARGE MOMENTUM TRANSFER TO THE PROTON IN THE PRIMARY-MOMENTUM INTERVAL FROM 1.25 TO 2.64 GeV/c. Abramov, B.M.; Dukhovskoĭ, I.A.; Kishkurno, V.V.; Kondratyuk, L.A.; Krutenkova, A.N.; Kulikov, V.V.; Radkevich, I.A.; Fedorets, V.S. (Institute of Theoretical and Experimental Physics). JETP Lett. 22: No. 1, 23-25 (5 July 1975).

The differential cross section of the reaction $\pi^- + d \to p + \pi^- + n$ (at a c.m.s. proton emission angle close to 0°) was measured in the momentum interval from 1.25 to 2.64 GeV/c. The measured cross sections turned out to be equal, within the limits of statistical accuracy, to the cross section of elastic π^-p backscattering at the investigated energies. The result confirms the important role played in this process by the interaction in the final state. (auth)

10410 ENERGY CHARACTERISTICS OF π^--MESON INTERACTIONS WITH NUCLEI AT 50 GeV. Vionov, V.F.;

Gaĭtinov, A.Sh.; Chasnikov, I.Ya.; Salomov, Dzh.; Tolstov, K.D.; Khoshmukhamedov, R.A.; Shabratova, G.S.; El-Nagy, A.; Solov'eva, Z.I.; Adamovich, M.I.; Larionova, V.G.; Orlova, G.I.; Tret'yakova, M.I.; Kharlamov, S.N.; Chernyavskii, M.M.; Azimov, S.A.; Bondarenko, R.A.; Gulamov, K.G.; Petrov, V.I.; Trofimova, T.P.; Chernova, L.P.; Chernov, G.M. JETP Lett. 22: No. 1, 25-27 (5 July 1975).

The momenta of secondary charged particles from π^--meson interactions with nuclei at 50 GeV were measured by an emulsion method in a strong magnetic field. It is shown that the average transverse momenta and the fractions of the energy carried away by particles with opposite charges depend little on the target-nucleus dimensions. The data do not agree with the concept that the primary pion is completely passive after collision at 50 GeV. (auth)

10411 TWO-PARTICLE CORRELATIONS IN INCLUSIVE AND SEMI-INCLUSIVE $\pi^- p$ REACTIONS AT 200 GeV/c. Biswas, N.N.; Bishop, J.M.; Cason, N.M.; Fokitis, E.D.; Kenney, V.P.; Shephard, W.D. (Department of Physics, University of Notre Dame, Indiana 46556); Lamsa, J.W.; Walker, W.D.; Loos, J.S.; Fortney, L.R.; Goshaw, A.T.; Robertson, W.J.; Harrison, D.M.; Levman, G.; Prentice, J.D.; Sreedhar, V.A.; Yoon, T.S.; Hartner, G.; Patel, P.M.; Vallet, S. Phys. Rev. Lett. 35: No. 16, 1059-1062 (20 Oct 1975).

Significant two-particle correlations of dynamical origin are observed in 200 GeV/c $\pi^- p$ inclusive interactions. This is demonstrated by comparison with kinematic correlations calculated from an independent-particle-emission model. Two distinct correlation types are observed: (a) unlike-particle correlations with correlation length ~1.3 rapidity units independent of azimuthal separation, and (b) like-particle correlations with correlation length ~0.4 rapidity units which are observed only for small azimuthal separations. (auth)

10412 PRELIMINARY ANALYSIS FOR THE X^0 (956) MESON. Uphadhyay, P. N. (Gaya Coll., India). Indian J. Phys.; 49: No. 5, 405-406(May 1975).

The production and decay of the η(958) produced in $\pi^- p \rightarrow \eta(958)$ reaction near the production threshold were studied. An enhancement was found near mass 956 MeV/c^2 and identified as the η(958). The estimated mass agrees with previous results. (JFP)

10413 A COMPARISON OF PION PRODUCTION IN THE REACTION $K^- p \rightarrow \Lambda$ + PIONS AT 8.25 GeV/c WITH ANTI pp AND ANTI ee ANNIHILATION DATA. Fry, J. R.; Muirhead, H. (Liverpool Univ. (UK)); Apostolakis, A.; Kakoulidou, M.; Michaelidou, H.; Michaelidis, P.; Vasiliadis, G. (Athens Univ. (Greece)); Filippas, T. A.; Grammatikakis, G.; Papadopoulou, T. Nucl. Phys., B; 95: No. 3, 365-379(8 Sep 1975).

Data is presented on the production of charged and neutral pions in the hypercharge annihilation reaction $K^- p \rightarrow \Lambda$ + pions at 8.25 GeV/c. Using the concept of available energy the data is compared with that from the processes anti pp annihilation, and positron-electron annihilation to hadrons. The measure of agreement among the three samples of data is in contrast with the behavior of non-annihilation data, which is presented for comparison, and indicates that over the present energy range this approach is a useful phenomenological way of looking at the annihilation process. (NL)

10414 MEASUREMENT OF THE $J/\psi(3100)$ DECAY WIDTHS INTO e^+e^- AND $\mu^+\mu^-$ AT ADONE. Esposito, B. (CNEN, Frascati, Italy); Felicetti, F.; Peruzzi, I. Lett. Nuovo Cim.; 14: No. 3, 73-81(20 Sep 1975).

Preliminary results on the J(3100) decay into lepton pairs is reported. Results on the e^+e^- and $\mu^+\mu^-$ pair angular distributions and on the partial decay widths are given. These results are compatible with a J^{PC} 1^{--} assignment for the J(3100). The total cross sections are also shown. (JFP)

10415 LOW ENERGY PION-NUCLEON AND PION-DEUTERON INTERACTIONS. Burman, R. L. (Los Alamos Scientific Lab., NM). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 41-54(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

In this survey one concentrates on current experiments in the fields of pion-nucleon and pion-deuteron interactions, for low energy incident pions--below 300 MeV. The discussion is mostly restricted to very recent work. The topics to be covered are: pi/sup +-/p yields pi/sup +-/p elastic scattering, pi/sup +-/p yields pi/sup +-/p gamma bremsstrahlung, pi^+d yields pp absorption, pi d yields pi^+d elastic scattering, and pi^+d yields pi^+pn breakup. (auth)

Particle Interactions and Properties (Theoretical)

Refer also to abstracts 9983 and 10966.

General

10416 (CONF-720133-P6) IV BRAZILIAN SYMPOSIUM ON THEORETICAL PHYSICS, RIO DE JANEIRO, BRAZIL, 4 JANUARY 1972. Volume VI. Woo, C. H.; Robilotta, M. R.; Silva, A. J.; Brandt, R. A. (Sao Paulo Univ. (Brazil). Instituto de Fisica; New York Univ., N. Y. (USA). Dept. of Physics). 1972. 56p. Dep. NTIS (US Sales Only) $6.00.

Separate abstracts were prepared for the two papers presented. (JFP)

For abstracts of individual papers see: 10417 and 10571.

10417 (CONF-720133-P6, pp 21-52) LIGHT CONE EXPANSIONS IN PARTICLE PHYSICS. Brandt, R. A. (New York Univ., NY). 1972.

From 4th symposium on theoretical physics; Rio de Janeiro, Brazil (4 Jan 1972).

In IV Brazilian symposium on theoretical physics. Vol. VI.

The discussion of light cone expansions in particle physics includes the reason for the light cone, scaling functions, scaling at SLAC, connection with the R limit, scale invariance in short-distance expansions, free-field light-cone expansions, light-cone expansions in perturbation theory, lessons from SLAC, and the canonical formalism. (JFP)

10418 (GIFT-9/75) GYROMAGNETIC RATIO AND GALILEAN SYMMETRIES IN THE LIGHT CONE FORMULATION; I. FORMULATION BASED ON THE BARGMANN-WIGNER FIELD EQUATIONS. Elizalde, E.; Gomis, J. (Barcelona Univ. (Spain). Departamento de Fisica Teorica). 1975. 20p. Dep. NTIS (US Sales Only) $3.50.

The gyromagnetic ratio of an arbitrary spin particle is obtained using the light cone formulation and within the framework of the Bargmann–Wigner equations. The result $g = 1/s$ for a particle of spin s predicted by Belinfante is found. (auth)

10419 (INIS-mf-1783) "CROSS-OVER" IN DIFFRACTION DISSOCIATIONS. Caldas, I. L. (Sao Paulo Univ. (Brazil). Instituto de Fisica). 1973. 60p. (In Portuguese). INIS.

Diffraction dissociations are assumed to occur in two independent stages: coherent excitation of one (or both) of the incident particles, and decay of the excited states. The amplitude for the formation of these excited states, as a function of the incident energy $\sqrt{s}$ and the mass M of each excited state, is obtained by using the eikonal approximation. For this calculation we suggest the use of the $\sqrt{s}$- dependent elastic eikonal phase coming from the differential cross-sections of the corresponding elastic reactions measured at the same energies at which the diffraction dissociations being studied occur. Thus the observed cross-over in the reactions $\pi^\pm p \rightarrow (\pi^\pm\pi^+\pi^-)p$ and $K^0 + p \rightarrow Q^0 + p$, $\bar{K}^0 + p \rightarrow \bar{Q}^0 + p$ is obtained as a consequence of the occurrence of this effect in the elastic reactions $\pi^\pm p \rightarrow \pi^\pm p$ and $K^\pm p \rightarrow K^\pm p$. The variation in the width of the diffractive peak as a function of $\sqrt{s}$ and M, for these and other diffraction dissociations is obtained and compared with experimental data. (auth)

10420 (USIP-75-07) FINITE CROSSING SUM RULES FOR HELICITY AMPLITUDES OF MULTI-PARTICLE REACTIONS WITH GENERAL SPINS AND MASSES. Johnson, D. (Stockholm Univ. (Sweden). Fysiska Institutionen). Apr 1975. 34p. Dep. NTIS (US Sales Only) $4.00.

Using one-tetrad amplitudes, it is shown how to derive finite crossing sum rules for a reaction of the form n particles → n′ particles, where the particles have general spins and masses. The case of 2 → 3 particles is worked out in detail, and general formulas are given for the sum rules. An application is made to a reaction with spin structure $1/2 + 1/2 \rightarrow 1/2 + 1/2 + 0$. (auth)

10421 CORRELATION IN THE CLUSTER PRODUCTION AND SEMI-INCLUSIVE CORRELATION. Glen, T. T. (Memorial Univ. of Newfoundland, St. John's). Nuovo Cim., A; 29A: No. 2, 267-282(21 Sep 1975).

The correlation of the production clusters within the ρ-ρ and truncated Poisson-distribution models for cluster decay is studied by investigating the variation of the average number of clusters $\overline{p(z)}$ in terms of the multiplicity of the inclusive reaction process. It is found that in both models $\overline{p(z)}$ deviates drastically from the n-independent value $\bar{p}$ which would have been obtained had the clusters been produced independently. One also calculates the neutral-charge particle correlation $\overline{n_0(n_-)}$ from the topological cross section with the cluster correlation effect included and find that $\overline{n_0(n_-)}$ does not dip down strongly enough as seen in experimental data. One then tries to obtain $\overline{n_0(n_-)}$ by considering the cluster correlation effect only up to the 3rd Mueller's moments available in experiments and finds that, instead of decreasing, $\overline{n_0(n_-)}$ keeps increasing with n_- for $n_- \geq 6$. It is therefore concluded that higher than 3rd orders of cluster correlation must probably play an important role in depressing the charge-neutral particle

correlation at higher values of n_-. Finally, and also principally, one would like to point out that, although the difference in the values of $\langle k(k-1)\rangle_n / \langle k\rangle_n$ for the independent and nonindependent cluster production cases can easily be recognized, it is, however, impossible, at present, to detect this difference from the semi-inclusive rapidity correlation, contrary to what was stressed in the literature. (auth)

10422 ELEMENTARTEILCHENPHYSIK. (Elementary Particle Physics). Gasiorowicz, S. Mannheim, F. R. Germany; Bibliographisches Institut (1975). 742p.

With figs., tabs. and refs.

A comprehensive survey of elementary particle theory is presented. Quantum field theory, helicity formalism, analyticity, and SU(3) are developed and used for discussions of experiments on decays of resonances, meson (π)-nucleon scattering, peripheral resonance production, electromagnetic form factors, and weak interactions. Included are partially conserved axial vector currents, the Cabibbo theory, and the foundations for the Weisberger sum rule for the axial renormalization constant. Very high energy elastic scattering and the phenomenological interpretation of experiments are also considered. (auth)

10423 STRINGS, CONDUCTIVE AND OTHERWISE. Willemsen, J. (Stanford Linear Accelerator Center, Calif. (USA)). pp 370-387 of Trends in Elementary Particle Theory. Rollnik, H.; Dietz, K. (eds.) (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Berlin; Springer (1975).

4 figs.

A model is described, which is motivated by an attempt to circumvent some of the difficulties in quantization by identifying canonical variables different from the coordinates of the string, already at the classical level. (GE)

10424 LARGE TRANSVERSE MOMENTUM PHENOMENA: AN EXPERIMENTAL AND THEORETICAL REVIEW. Ellis, S. D. (CERN, Geneva); Thun, R. pp 37-74 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

A review is presented of both experimental and theoretical results on large transverse momentum inclusive processes. The experimental topics include single-particle cross sections, particle composition and correlations at large $p_\perp$. The characteristics and predictions of the various theoretical models are described. The similarities and differences between the models are discussed with emphasis on those features which allow experimental discrimination. (auth)

10425 DUALITY, HIGH MOMENTUM TRANSFERS AND COMPOSITE PARTICLE MODELS. Coon, D. D. (Univ. of Pittsburgh). pp 95-102 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

The relation between dual models, parton models, and the strength of the gluon coupling constant (g) is discussed. The connection between composite particle models of the large -t region and the resonance region is examined. Also discussed is a dual model argument of Arik and Coon in which quark production is estimated to be of the order of $\exp(-g^2/2) \times$ typical hadronic cross sections. Phenomenologically, g is sufficiently large that quark production may well be unobservably small. (auth)

10426 DUAL PERIPHERAL MODEL. Schrempp, B.; Schrempp, F. (CERN, Geneva). pp 113-134 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

An s channel approach to nondiffractive two-body reactions at high energies is reviewed. The amplitudes are described in terms of one single peripheral Regge trajectory $\alpha(s)$ in the s channel [Re $\alpha(s) + 1/2 \simeq k \cdot R$, R = hadron radius $\simeq$ 1 fermi] and its analytic continuation $\alpha(u)$ to the u channel. Im $\alpha(s)$ is determined at high energies from Re $\alpha(s)$ via an (inverse) dispersion relation. The resulting nonlinear, complex trajectory $\alpha(s)$ turns out to generate interesting t channel Regge (pole and cut) features involving an effective nonlinear t channel trajectory $\alpha(t) \simeq \alpha_0 (R/\pi)\sqrt{-t}$ (for $-t \gtrsim 0.25$ GeV^2). Consequences are discussed, various tests and also new applications are presented. (auth)

10427 MULTIPLICITY DISTRIBUTION IN IMPACT PARAMETER SPACE. Sakai, N. (Max-Planck-Inst. for Physics and Astrophysics, Munich). pp 435-443 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

The formulation of inclusive overlap functions which give multiplicity distributions at incident impact parameter b is summarized. Several models of the multiperipheral type are discussed. It is pointed out that the dependence of the momentum-transfer slope upon subenergies is important in knowing which collision, central, or peripheral, has higher multiplicity. (auth)

10428 CLUSTER MODEL AND STRUCTURE IN THE TWO-PARTICLE RAPIDITY PLANE IN INCLUSIVE AND SEMI-INCLUSIVE CORRELATIONS. Ranft, G. (CERN, Geneva). pp 445-450 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

A detailed study of the structure in the rapidity plane allows one to determine the amount of single and double diffraction within a cluster model. From semi-inclusive data on correlations the average number of particles due to decay of one cluster can be estimated. (auth)

10429 PROPOSED MEDIUM INTERACTION AND THE NEW MESONS. Cung, V.K.; Kim, C.W.; Sato, A. (Department of Physics, The Johns Hopkins University, Baltimore, Maryland 21218). Phys. Rev. D 12: No. 5, 1433-1445 (1 Sept 1975).

Under the assumptions that (1) the newly discovered particles with 3.1 and 3.7 GeV masses are bound states of a charmed quark and a charmed antiquark and (2) the Okubo-Zweig-Iizuka rule is valid exactly in the strong interaction, we propose a new fundamental interaction. This interaction is mediated by a triplet of chiral $(V-A)$ SU(2) gauge bosons and has an effective strength between those of the electromagnetic and weak interactions. Decay properties of the new particles are investigated systematically. Also discussed are decay properties of charmed particles and a $J^P = 0^-$ charmed-quark-antiquark bound state, as well as some consequences of the medium interaction in low energy. (auth)

10430 LEPTON COUPLING IN THE PROPOSED MEDIUM INTERACTION AND BREAKDOWN OF MUON-ELECTRON UNIVERSALITY. Kim, C.W.; Sato, A. (Department of Physics, The Johns Hopkins University, Baltimore, Maryland 21218). Phys. Rev. D 12: No. 5, 1446-1453 (1 Sept 1975).

It is argued from analyses of experimental data that the gauge bosons B which mediate the proposed medium interactions may couple to a doublet of the muon and heavy muon but not to the electron. This conjectured μ-B gauge coupling seems to explain the apparent small breakdown of μ-e universality observed in elastic and inelastic $\mu+p$ scattering and leptonic decay of ϕ meson. The mass of B is estimated to be around 4 GeV. It is also shown that the anomalous bump (after ψ and ψ' are subtracted) indicated in muon-pair production in high-energy hadron collisions can be explained qualitatively as an effect of muon-pair production via a virtual B boson. Several other consequences of the μ-B coupling are discussed. (auth)

10431 THE NEW PARTICLES—WHAT GOOD ARE THEY? Dreitlein, J. (University of Colorado, Boulder, Colorado 80302). Phys. Teacher 13: No. 8, 476-479 (Nov 1975).

A simple quark model incorporating charm is to discuss the properties of the Ψ (3095) and Ψ (3684) particles. (AIP)

10432 QUARK MASSES IN A MODEL OF PARTONS AND CONSTITUENTS. Bongardt, K. (Univ., Karlsruhe, Ger.); Genz, H.; Katz, J. Lett. Nuovo Cim.; 14: No. 1, 31-35(6 Sep 1975).

Previous SU(3) assumptions are extended. In this way it is found that $m_\lambda^2 - m_u^2 = 5m_u^2 = 0.1$ (GeV)^2 for the masses m_λ and m_u of the λ and p quarks, respectively. Combining this relation with the usual quark mass relation $m_s/m_u = \sqrt{2} - 2C/C + \sqrt{2} = 24$ (which implies large splittings), one obtains $m_u = 13$ MeV and $m_s = 317$ MeV. (JFP)

10433 UNIFIED GAUGE THEORIES OF ELEMENTARY PARTICLES. Leader, E.; Williams, P. G. (Westfield Coll., London). Nature (London); 257: No. 5522, 93-99(11 Sep 1975).

It is stated that recent theories which unite weak and electromagnetic interactions provide new hope for a unified theory of fields and their interactions. Experimental developments such as the discovery of neutral currents and the new Ψ particles lend encouraging support for some of the ideas embodied in these theories. (auth)

10434 GROUP THEORETICAL CALCULATIONS OF TRACES AND DETERMINANTS OCCURRING IN DUAL THEORIES. Bruce, D. (Durham Univ. (UK)); Corrigan, E.; Olive, D. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 95: No. 3, 427-433(8 Sep 1975).

A group theoretical calculation is given of all the functions, defined in terms of infinite matrixes, which occur in the dual theory of fermions and off-mass shell states when treated in the operator formalism. (NL)

10435 SU(6)$_W$ AND DECAYS OF BARYON RESONANCES. Hey, A. J. G.; Litchfield, P. J. (European Organization for Nuclear Research, Geneva (Switzerland)); Cashmore, R. J. (Oxford Univ. (UK). Nuclear Physics Lab.). Nucl. Phys., B; 95: No. 3, 516-546(8 Sep 1975).

The decay rates of baryon resonances assigned to the $(70,1^-)$ and $(56,2^+)$ representations of SU(6)$_W \times O(3)$ are subjected to a detailed comparison with an SU(6)$_W$ model motivated by the recent work of Melosh. It is concluded that SU(6)$_W$ is remarkably successful as an approximate symmetry for decay vertices. (NL)

10436 QUARK BINDING IN TWO DIMENSIONS. Hagen, C. R. (Rochester Univ., N. Y. (USA). Dept. of Physics and Astronomy). Nucl. Phys., B; 95: No. 3, 477-480(8 Sep 1975).

A two-dimensional model recently proposed by 't Hooft to obtain quark binding is considered. It is shown that the model is inconsistent as a result of an anomaly which occurs in the divergence of the current operator. In addition, the claim that the single quark state is suppressed is shown to be the result of an improper treatment of the long-range Coulomb interaction. (NL)

10437 WHY POLARIZED ELECTROPRODUCTION IS INTERESTING. Close, P. E. (CERN, Geneva). pp 285-306 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

The data on inelastic electroproduction both in the resonance and deep inelastic regions are reviewed, the similarities between them noted and the consequences for parton models and Bloom-Gilman and Rittenberg-Rubinstein duality discussed. A preview of polarized electroproduction is made. Theoretical predictions suggest that the polarization asymmetry in the deep inelastic scattering will have opposite sign to that in photoproduction and hence some interesting Q^2 dependent effects are expected. However, the available data in the resonance region do not show for such a dependence and so it seems possible that either Rittenberg-Rubinstein duality will be in difficulty or that theoretical expectations based on quark partons and light cone algebra for the deep inelastic asymmetry are incorrect. (auth)

10438 HIGH-ENERGY PHYSICS AND NUCLEAR STRUCTURE: 1975. Proceedings of a Conference Held in Santa Fe and Los Alamos, New Mexico, June 9-13, 1975. Nagle, D. E.; Burman, R. L.; Storms, B. G.; Goldhaber, A. S.; Hargrave, C. K. (eds.). AIP Conference Proceedings No. 26. New York; American Institute of Physics (1975). 634p. (CONF-750631-).

Separate abstracts were prepared for the 42 papers presented. (JFP)

For abstracts of individual papers see: 10286, 10287, 10355, 10356, 10362, 10363, 10370, 10371, 10391-10393, 10415, 10439, 10453, 10485-10487, 10500-10502, 10517-10520, 10532, 10555-10557, 10564, 10569, 10636, 10637, 10688, 10844, 10845, 10909, and 11030-11035.

10439 MULTIPARTICLE PRODUCTION ON NUCLEI: THEORY. Bertocchi, L. (Univ., Trieste, Italy). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 238-264(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Models for multiparticle production at very high energies on nuclear targets are reviewed. In particular, the predictions following from the space-time description of the multiperipheral model and of the energy flux model are discussed. Other models, as well as the predictions for production in nucleus-nucleus collisions are briefly treated. (auth)

Electromagnetic

Refer also to abstracts 10561, 11141, and 11151.

10440 (DESY-75/35) JETS IN INCLUSIVE e^+e^- AND LEPTOPRODUCTION. Gronau, M.; Walsh, T. F.; Zarmi, Y.; Lam, W. S. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Sep 1975. 21p. Dep. NTIS (US Sales Only) $4.50.

In e^+e^- annihilation the coefficient of the $\cos^2\theta$ term (α) of single particle inclusive distributions exhibits a unique dependence on the observed particle momentum. This dependence provides a measure of $\langle p_T^2 \rangle$ in a jet. In two particle inclusive annihilation the average of the squared relative p_T is determined by the same parameter and by the momenta of the two particles. The observation that in the current fragmentation region of leptoproduction the p_T distribution of fast hadrons is broader than that of slow ones is explained. (auth)

10441 UNIFIED MODELS OF ELECTROMAGNETIC AND WEAK INTERACTIONS. Pietschmann, H. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik; Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). pp 40-65 of Trends in Elementary Particle Theory. Rollnik, H.; Dietz, K. (eds.) (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Berlin; Springer (1975).

2 figs.; 3 tabs.; 14 refs.

After a brief summary of our knowledge on weak interactions the total weak neutral current is considered under the assumptions that neutral currents are of vector nature and the hadronic parts can be constructed out of quarks. The study of actual gauge models is started with the Salam-Weinberg model and extended by the Higgs field to circumvent the mass problem of intermediate bosons. The problem of no neutral strangeness changing transitions is discussed using charm and color. (GE)

10442 NUCLEON STRUCTURE EFFECTS IN PION-NUCLEON BREMSSTRAHLUNG. Picciotto, C. (CERN, Geneva). Nuovo Cim., A; 29A: No. 1, 41-48(1 Sep 1975).

Cross sections for the process $\pi^-p \to \pi^-p\gamma$ are studied in a region which should be quite sensitive to off-shell effects of the nucleon electromagnetic vertex. Comparison with a recent experiment at 294 MeV shows that, while good agreement is obtained in general for photons of energy up to 50 MeV, for higher photon energies the assumption of threshold dominance in a dispersion relation calculation of the form factors yields results which are incompatible with the data. As with NN bremsstrahlung, it is found that the data favor abandoning the threshold dominance assumption for one of the form factors. (auth)

10443 MAGNETIC MOMENTS OF THE GROUND-STATE BARYONS IN THE NONRELATIVISTIC FREE-QUARK MODEL. Sebastian, K. J. (Lowell Technological Inst., MA). Nuovo Cim., A; 29A: No. 1, 1-12(1 Sep 1975).

It is shown that the assumption of the identity between the current and the constituent quark in the nonrelativistic free-quark model does not lead to the vanishing of the anomalous magnetic moments of the nucleon but, on the contrary, it reproduces the correct ratio $(-3/2)$ between the magnetic moments of the proton and the neutron. By pointing out the mechanism by which the above model produces this desirable result, it is then shown that identity of the current and the constituent quark in this context does not imply the identity of the $SU_{6w,\,currents}$ charges with the generators of the $SU_{6w,\,constituent}$ symmetry. One also resolves an apparent contradiction between this result and one of Melosh's assertions regarding the magnetic moments of the baryons. In particular it is shown that within the framework of the nonrelativistic free-quark model the result is consistent with the Melosh transformation between the current and the constituent quark. In the same framework one also points out an easy way to implement the Melosh transformation in the calculation of the hadronic-current matrix elements. (auth)

10444 ELECTRON LASER-PULSE SCATTERING. Slaughter, M. D. New Orleans; Univ. of New Orleans (1974). 73p. University Microfilms Order No. 75-10,816.

Thesis (Ph. D.)

General formulas are derived for the computation of scattering amplitudes for electron-laser pulse processes. The results make use of standard Feynman-Dyson S-matrix techniques, except the Furry interaction picture is used rather than the Dirac interaction picture. The laser pulse is described quantum-mechanically as a coherent state wave-packet. The electron is represented by wave-packet solutions of the Dirac equation in the case of scattering boundary conditions, or by Volkov wave-packets when one desires nonscattering boundary conditions. The scattering amplitudes for the processes of stimulated Compton scattering, inverse bremsstrahlung, and pair production in a laser pulse are given for scattering and nonscattering boundary conditions. The existence of entirely new, quantum-electrodynamical, nonlinear corrections for any electron-laser pulse process is demonstrated. (Diss. Abstr. Int., B)

10445 PROCEEDINGS OF THE NINTH RENCONTRE DE MORIOND. Volume II. High Energy Leptonic Interactions. Conference Held at Meribel-les-Allues, France, March 3-15, 1974. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974). 330p. (CONF-740332-P2).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974).

Abstracts were prepared for the seventeen papers presented. (JFP)

For abstracts of individual papers see: 10360, 10361, 10367-10369, 10437, 10446-10452, 10473-10475, and 10559.

10446 e^+e^-: SIX OR MORE PIONS IN SEARCH OF A THEORY. Rubinstein, H. R. (CERN, Geneva). pp 181-192 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

A few models of hadronic annihilation of electrons and positrons are discussed: models with a large number of opening thresholds such as one recently developed by Ferro Fontan and the author, and the nucleon–antinucleon analog model. New observations on both models are reviewed. One then turns to the renormalization group and discusses its genetic changes under the new environment produced by Frascati, CEA and SPEAR. (auth)

10447 VECTOR MESONS AND e^+e^- ANNIHILATION. Renard, F. M. (Dept. de Physique Mathematique, Montpellier, France). pp 193-216 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332- P2.

One extends to the ω-φ case the treatment of the finite width and of the inelastic effects proposed previously for the ρ case; this leads to a complex and energy dependent ω-φ mixing formalism. Applications are made to the computation of the ρ, ω, φ interference effects and of their high energy tails in the reactions $e^+e^- \to 2\pi$, 3π, $K\bar{K}$, $\pi\gamma$, $\eta\gamma$. The possible existence of higher vector mesons is considered in an ideal nonet structure similar to the ordinary vector meson one. Using SU_3 and quark model relations one predicts the coupling constants and the width of the members of the two first nonets V' and V''. Their effects (including the ρ-$\rho'(1.3)$ mixing) are shown in the reactions $e^+e^- \to 2\pi$, 3π, $K\bar{K}$, $\pi\gamma$, $\eta\gamma$. The asymptotic behavior of $\sigma_{tot}(e^+e^- \to \text{hadrons})$ is shown in connection with the existence of an infinite series of vector mesons. The possibility of the limiting case where a strong mixing of many overlapping states occurs is emphasized. (auth)

10448 POSSIBLE ROLE OF TWO PHOTON PROCESSES IN HIGH ENERGY COLLIDING BEAM EXPERIMENTS. Greco, M. (CNEN, Frascati, Italy). pp 217-220 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

A critical analysis is presented of the theoretical expectations for the process $\gamma\gamma \to$ hadrons and its implications for high energy e^+e^- annihilation into hadrons. (auth)

10449 ELECTROMAGNETIC PROPERTIES OF HADRONS IN A RELATIVISTIC QUARK MODEL. Boehm, M. (CERN, Geneva); Joos, H.; Krammer, M. pp 221-230 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

Results from a relativistic dynamical quark model are presented for: the vector-meson-photon coupling constants for ordinary and heavy vector mesons; the total e^+e^- annihilation into hadrons; the pion form factor in the space- and time-like region. (auth)

10450 INCLUSIVE PHOTOPRODUCTION AND THE TRIPLE REGGE FORMULA. Gandsman, J. (Paris Univ., Orsay, France). pp 231-246 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF–740332-P2.

Study of the inclusive reactions $\gamma p \to \pi^\pm$ + anything and $\gamma n \to \pi^-$ + anything at the photon energy of 7.5 GeV is reported. The high π^+/π^- ratio observed in the target fragmentation region is explained by applying the triple regge formalism. One also investigates the inclusive photoproduction of the Δ^{++} and ρ^0 resonances. (auth)

10451 ELECTROPRODUCTION IN A STREAMER CHAMBER: MULTIPLICITIES, INCLUSIVE CROSS SECTIONS AND VECTOR MESON PRODUCTION. Nagel, H. (DESY, Hamburg). pp 247-266 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

Hadron production by ep scattering in the kinematical region $0.3 < Q^2 < 1.5$ GeV^2 and $1.3 < W < 2.8$ GeV^2 was studied in a streamer chamber at DESY. The average multiplicity of charged hadrons $\langle n \rangle$ is consistent with a logarithmic s dependence: $\langle n \rangle \sim 0.8 + \ln s^2/m^2$. The multiplicity does not scale with respect to ω' and ω_W. The normalized invariant π^- cross section, F(x), for fixed W shows no Q^2 dependence if ρ^0 events are removed from the data. In the nondiffractive region, $3.5 < \omega' < 10$, the slope of the p^2 distribution decreases with Q^2 for fixed ω'. In the beam fragmentation region a longitudinal/transverse interference term was observed. The Q^2 dependence of $\sigma(\gamma_V p \to \rho^0 p)$ and $\sigma(\gamma_V p \to \omega p)$ is essentially determined by the ρ/ω propagator as suggested by VDM. For $W > 2.2$ GeV the decay angular distribution in the helicity system shows that ρ^0 mesons are produced predominantly by transverse photons but a nonzero longitudinal contribution is also seen. (auth)

10452 DUAL QUARKS AND PARTON QUARKS. Kitakado, S. (DESY, Hamburg). pp 307-328 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

The constraints of duality are imposed on the structure functions of total as well as one particle inclusive deep inelastic electron-nucleon scattering. (auth)

10453 NUCLEAR STRUCTURE, WEAK, AND ELECTROMAGNETIC INTERACTIONS IN NUCLEI. Frauenfelder, H. (Univ. of Illinois, Urbana). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 448-453(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The role of nuclei in understanding the weak and the electromagnetic interactions and the importance of these interactions in investigating nuclear structure are surveyed. (auth)

10454 IS THE RELATION $R \simeq 16\pi^2/f_\rho^2$ OF PHYSICAL SIGNIFICANCE? Terazawa, H. (The Rockefeller University, New York, New York 10021). Phys. Rev. D 12: No. 5, 1506-1507 (1 Sept 1975).

It is shown that the present remarkable agreement between the previously predicted asymptotic limit $R \simeq 16\pi^2/f_\rho^2$ ($=5.7 \pm 0.9$) of $\sigma(e^+e^- \to \text{hadrons})/\sigma(e^+e^- \to \mu^+\mu^-)$ and the recently reported SLAC-LBL e^+-e^- colliding-beam data with $R = 5.1 \pm 0.4$ at 5 GeV center-of-mass energy is of physical significance if R stays approximately constant for higher energies. (auth)

10455 HEAVY QUARKS AND LONG-LIVED HADRONS. Appelquist, T. (Institute for Advanced Study, Princeton, New Jersey 08540); Politzer, H.D. Phys. Rev. D 12: No. 5, 1404-1414 (1 Sept 1975).

In a recent Letter we reported on some work which led us to suggest the possibility of narrow spikes in the e^+e^- annihilation cross section into hadrons. In this paper, we discuss the theoretical infrastructure of this work more thoroughly, and improve and extend the calculations and experimental predictions. We examine a colored quark-gluon model of hadronic matter, with color an exact SU(3) gauge symmetry. In addition to the light quarks that make up ordinary hadrons, a heavy quark, such as the charmed c, is included. The narrow resonances recently discovered by the MIT-BNL and SLAC-LBL groups are interpreted as $c\bar{c}$ bound states (orthocharmonium). In this energy range, the effective coupling has become small according to asymptotic freedom, and many aspects of the bound-state structure can be calculated. The existence of 0^- (paracharmonium) states is predicted, and decay widths and mass splittings are estimated. The total e^+e^- cross section into hadrons is predicted to scale asymptotically, with an approach to scaling from above that can be calculated over a large energy range. (auth)

10456 FINAL-STATE INTERACTIONS IN RADIATIVE MESON-PAIR PRODUCTION BY e^+e^- ANNIHILATIONS. Izquierdo, J.M. (Junta de Energía Nuclear, Madrid-3, Spain); Yndurain, F.J. Phys. Rev. D 12: No. 5, 1415-1428 (1 Sept 1975).

We consider the contribution to the process $e^+e^- \to B\bar{B}\gamma$, where B is a meson, of the rescattering of the $B\bar{B}$. It is shown that these rescattering contributions can be calculated with reasonable accuracy in some situations, in particular, when $B\bar{B} = \pi\pi$ and $M_{\pi\pi}$ is in the region of the ϵ ($\sim$700 MeV) and when $B\bar{B} = K\bar{K}$ and $M_{K\bar{K}}$ is in the region of the S^* ($\sim$1 GeV). Hence, it is shown that measurements of the cross section for $e^+e^- \to B\bar{B}\gamma$ will give reliable information on the $\pi\pi$ and $K\bar{K}$ phase shifts in regions where this information will be very interesting. Taking reasonable figures for these phase shifts, it is shown that the experiments are feasible, i.e., the cross sections $e^+e^- \to B\bar{B}\gamma$ are such that they are within the measurement possibilities of existing machines (on the order of a few nb). (auth)

10457 SEMILOCAL DUALITY IN π^0 PHOTOPRODUCTION. Armenian, H.K.; Goldstein, G.R.; Rutherfoord, J.P.; Weaver, D.L. (Tufts University, Physics Department, Medford, Massachusetts 02155). Phys. Rev. D 12: No. 5, 1278-1282 (1 Sept 1975).

It is found that a simple effective Regge parameterization of high-energy differential-cross-section data for π^0 photoproduction when extrapolated to energies below 3 GeV satisfactorily explains the small-

ψ data, except for the first resonance, in the sense of semilocal duality. (auth)

10458 MASS FORMULAS FOR THE ψ PARTICLES IN A COLOR SCHEME. Tsai, S.Y. (Department of Physics, Nihon University, Tokyo, Japan). Phys. Rev. Lett. 35: No. 16, 1062-1066 (20 Oct 1975).

We discuss possible mass spectroscopy of vector-meson states in a color scheme, namely the SU(3)⊗SU(3)″ scheme of Han and Nambu. Interesting mass formulas are derived under some dynamical assumptions. These are compared with those of Sanda and Terazawa. Two possible assignments for the ψ particles (including the one at ~4.1 GeV) are considered. (auth)

10459 DIFFRACTIVE PRODUCTION OF THE Ψ PARTICLE AND CHARMED MESONS IN PHOTON AND NEUTRINO INTERACTIONS. Pumplin, J.; Repko, W. (Department of Physics, Michigan State University, East Lansing, Michigan 48824). Phys. Rev. D 12: No. 5, 1376-1381 (1 Sept 1975).

We assume that the newly discovered mesons ψ (3.1) and ψ (3.7) are nonrelativistic bound states of charmed quarks, and show that available data are consistent with this picture. We calculate the diffractive production of ψ in the processes $\gamma A \to \psi A$ and $\mu A \to \mu \psi A$, where A is a proton or nucleus, and find a result which is different from the vector-meson-dominance prediction. We also calculate the reactions $\nu\ (\bar{\nu})\ A \to \mu\ (\bar{\mu})\ F^* A$, where F^* denotes the hypothetical particle with both charm and strangeness which is predicted by the SU(4) model. Our result appears to be compatible with the excess of events (compared to the parton model) seen in the inclusive reactions $\nu A \to \mu^- X$ and $\bar{\nu} A \to \mu^+ X$. (auth)

10460 ω-MIXING MODEL FOR THE PRODUCTION OF NONHADRONIC ψ'S. Neff, T.L. (Center for Theoretical Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139); Sachrajda, C.; Sivers, D.; Townsend, J. Phys. Rev. D 12: No. 5, 1488-1491 (1 Sept 1975).

We develop a simple, plausible model for the photoproduction and hadronic production of the ψ (3100) under the assumption that this state is not a hadron. In particular, we find the cross section $\sigma(\gamma N \to \psi N) \lesssim 3$ nb. Experimental results in this range will not unambiguously determine whether the ψ is a hadron. (auth)

10461 IS CHARM ESTABLISHED. Iwao, S. (Kanazawa Univ., Japan). Lett. Nuovo Cim.; 14: No. 1, 8-12(6 Sep 1975).

It is pointed out that the recent 1.8-GeV e^+e^- annihilation data could also be interpreted as the pair production of charmed mesons in association with an arbitrary number of pions. This conclusion is based on the approximate estimate of charged–neutral ratios of charmed particles both in hadronic production and e^+e^- annihilation studies. (JFP)

10462 GENERALIZED CHERENKOV RADIATION FROM TACHYONIC SOURCES. Rockower, E. B. Weltham, MA; Brandeis Univ. (1975). 165p. University Microfilms Order No. 75-24,833.

Thesis (Ph. D.).

The possibility of a generalized Cherenkov radiation is investigated which would result from the coupling of a superluminal (tachyonic) source to a short range "massive" field. One mainly focused on the properties of this "generalized Cherenkov radiation" by tachyons in a vacuum. The complementary problem of the source dynamics was also pursued, and its relation to Cherenkov radiation elucidated. (Diss. Abstr. Int., B)

10463 RELATION BETWEEN THE PROCESSES OF ELECTRON PRODUCTION AND INCLUSIVE ANNIHILATION $e^+e^- \to$ HADRONS FOR WEAKLY BOUND SYSTEMS. Ioffe, B. L.; Smilga, A. V. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 22: No. 1, 220-222(Jul 1975). (In Russian)

Bjorken has proposed that in weakly bound systems the invariant functions for electron production processes physically have nothing in common with the invariant functions of inclusive annihilation. The results of calculations made on $e + d \to e + p + n$ electron production processes and $e^+e^- \to \bar{d} + n + d$ annihilation processes to test Bjorken's assumption were reported. The results indicated that in the electron production process there is a relative increase of the invariant functions W_1 and W_2 in the kinematic region, corresponding to electron production on a proton, whereas in the annihilation process there is no similar effect. (JSR)

10464 RADIATIVE ASYMMETRY AROUND THE RESONANCE IN $e^+e^- \to \mu^+\mu^-$. Kraemmer, A. B.; Lautrup, B. (Niels Bohr Institutet, Copenhagen (Denmark)). Nucl. Phys., B; 95: No. 3, 380-396(8 Sep 1975).

Under the assumption that the psi is a pure 1-- vector particle the angular asymmetry has been calculated in the process $e^+e^- \to \mu^+\mu^-$ around the resonance. It is found that the asymmetry, calculated in the soft photon limit, becomes very small around the resonance. (NL)

10465 NEUTRON SCATTERING BY ELECTRONS IN A MAGNETIC FIELD. Elliott, R. J.; Kleppmann, W. G. (Oxford Univ.). J. Phys., C (London); 8: No. 17, 2737-2744(7 Sep 1975).

The diamagnetic cross section from neutron scattering for electrons in a magnetic field is considered, and shown to be a small effect for most systems. Band electrons with low effective mass m^* and large g in Landau states are, however, found to have relatively large cross sections near the forward direction, and it is proposed that Bragg scattering from a Wigner condensed phase of such electrons might be observable in spite of the low densities required. Detailed conditions for this scattering are given for several small-gap semi-conductors. Inelastic scattering from such electrons is also considered, but the cross sections are likely to be unobservable with present techniques. (auth)

10466 PARTIALLY CONSERVED DILATION CURRENT, THE ASYMPTOTIC LIMIT OF $\sigma(e^+e^- \to \text{HADRONS})/\sigma(e^+e^- \to \mu^+\mu^-)$ AND THE DECAYS OF ε AND S* TO 2γ. Eliezer, S. (Univ. of Massachusetts, Amherst). J. Phys., G (London); 1: No. 7, 701-708(5 Sep 1975).

The electromagnetic current trace anomaly is used to get the high energy cross section for $e^+e^- \to \gamma \to$ hadrons, and through partial conservation of the dilation current it is related to the coupling of the isoscalars ε and S* to two photons. The γγ and S* couplings are calculated in a model where the ε (or S*) dissociates into a pair of pseudoscalar mesons, which annihilates into two photons. The ratio $R = \sigma(e^+e^- \text{ hadrons})/\sigma(e^+e^- \mu^+\mu^-)$ is estimated, and the decay widths of $\epsilon \to \gamma\gamma$ and $S^* \to \gamma\gamma$ are calculated. (UK)

10467 ANNIHILATION OF e^+e^- AND $\bar{p}p$ AND STATISTICAL-MODEL CONSIDERATIONS. Eilam, G. (McGill Univ., Montreal); Hojvat, C.; Margolis, B.; Meggs, W. J.; Frautschi, S.; Pripstein, M. Lett. Nuovo Cim.; 14: No. 3, 108-112(20 Sep 1975).

A comparison is made of the e^+e^- annihilation data for multiplicities and $2\pi^+2\pi^-$ final state with data for the corresponding quantities in $\bar{p}p$ annhilation, as a function of energy. These data show a suggestive similarity. The similarity of these data leads one to consider a statistical picture for the two reactions involving an incoherent superposition of s-channel resonances. Total cross sections are also considered. The statistical bootstrap model is used. (JFP)

10468 GENERALIZED HADRONIC BREMSSTRAHLUNG MODEL AND TWO REGIMES IN HIGH ENERGY COLLISIONS. Soln, J. (Science Research Council, Daresbury, Eng.). J. Phys., G (London); 1: No. 7, 709-723(5 Sep 1975).

From conference on physics at ultra high energies; London, Eng. (4 Sep 1974).

The existence of lower and higher regimes in high energy multi-particle reactions has been argued recently by Bialas and Zalewski (Nucl.Phys.; B42:325(1972)) and independently by Berger and Krzywicki (Phys.Lett.; 36B:380(1971)). In each of the energy regimes, quantities like the average multiplicity and the correlation parameters should show markedly different behavior. Within the framework of the generalized hadronic bremsstrahlung model (in which the charge conservation is incorporated) on the one hand, the notion of two energy regimes as specifically suggested by Bialas and Zalewski is reinforced, while, on the other hand, it is shown that the small-scale oscillations in high energy proton-proton scattering might be considered as one of the characteristics of the higher energy regime. (auth)

Weak

Refer also to abstracts 10231 and 10563.

10469 (PUC-TN-9/74) HYPERON DECAYS INTO FOUR PARTICLES. Ferreira, E. M.; Lucena, L. S. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil). Instituto de Fisica). Jul 1974. 34p. INIS.

Disintegration processes in which a hyperon decays into a nucleon, a pion and a lepton pair are studied. We consider the most general form of the matrix element and write the general expression for the decay rate. We obtain the numerical values for the phase space integrals for the various decay processes and write the general formula for the decay probabilities in terms of form factors. The relations among different processes are analyzed and the possibility of their experimental observation is discussed. (auth)

10470 LEPTON PRODUCTION IN HADRONIC COLLISIONS, PARTONS, VECTOR MESONS, AND NEW PARTICLES. Renard, F. M. (Universite des Sciences et Techniques du Languedoc, Montpellier, France). Nuovo Cim., A; 29A: No. 1, 64-84(1 Sep 1975).

Predictions are given for lepton pair production taking into account new information about the quark partons (antiparton distributions from ν data, charm, color) and about the vector mesons (heavy vector mesons and Ψ-particles). Applications are given for various hadronic beams and energies in the cases where one detects either the pair of leptons or a single lepton. (auth)

10471 NEUTRAL CURRENTS, UNIFIED FIELDS, AND CHARM. Burhop, E. H. S. (University Coll., London). Endeavour; 34: No. 123, 136-143(Sep 1975).

High-energy physics seeks to understand the nature of matter in terms of particles and their interactions. Recent studies of neutrino interactions have provided impressive support for the quark model of the nucleon and established the existence of weak neutral current processes which can be understood in terms of a unified theory of weak and electromagnetic interactions. The failure to observe neutral currents in strangeness-changing weak interactions is interpretable in terms of a fourth quark having a new property called charm. The recent discovery of an entirely new type of particle (Ψ^0) may yield a clue to the possible existence of charmed mesons and baryons. (auth)

10472 STUDY OF THE INCLUSIVE PRODUCTION OF Λ^0 AND ANTI Λ^0 IN K^+p INTERACTIONS AT 8.2 AND 16 GeV/c. Grard, F. (Univ. of Mons, Belgium). pp 473-491 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

Single particle inclusive distributions of Λ^0 and $\bar{\Lambda}^0$ produced in K^+p interactions at 8.2 and 16.0 GeV/c are presented. The data are compared with the existing published data on the same reactions at 12.7 GeV/c and on Λ^0 productions in pp interactions, to test the limiting fragmentation and factorization hypothesis. (auth)

10473 INCLUSIVE NEUTRINO AND ANTINEUTRINO REACTIONS AND CHARGED CURRENTS. Gourdin, M. (Paris Univ). pp 21-50 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

The theoretical framework for a phenomenological analysis of high energy processes induced by neutrinos and antineutrinos is presented. Only the case of charged currents is considered. A special emphasis is given to charge symmetry and the parameters of the quark parton model are computed. (auth)

10474 INTRODUCTION TO WEAK NEUTRAL CURRENTS. Fayet, P. (Paris Univ., Orsay, France). pp 87-109 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

The question of weak neutral currents is presented in connection with the unified gauge theories of weak and electromagnetic interactions. (auth)

10475 WHAT DO WE LEARN FROM DEEP INELASTIC SCATTERING WITH POLARIZED TARGETS. Hey, A. J. G. (CERN, Geneva). pp 267-283 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

The kinematics and theoretical predictions for inelastic lepton-proton scattering off polarized targets are briefly reviewed. The Bjorken limit of this process provides stringent tests of parton and light cone ideas while the Regge limit exposes some of the more obscure parts of J plane folklore. (auth)

10476 HOW TO TEST A COLORED-QUARK MODEL FOR ψ PARTICLES. Terazawa, H. (The Rockefeller University, New York, New York 10021); Sanda, A.I. Phys. Rev. Lett. 35: No. 16, 1110-1113 (20 Oct 1975).

We present crucial tests of our assignment for the ψ particles in a colored-quark model. They include observations of (1) the predominant direct decays, ψ (3.1) and ψ (3.7) $\to\omega+X_{\text{inc}}$; (2) the chain decays, ψ (4.1) $\to\psi$ (3.1)$+X\to\mu^+\mu^-+X$ (X is an arbitrary hadronic state and X_{inc} is that with the vacuum quantum numbers); (3) the monochromatic meson emissions, ψ (4.1) $\to\pi+(\rho,\rho^0)$, $K+(K^*,\rho^0)$; and (4) the radiative decays, $\psi\to\gamma+2\pi\pi$, $\gamma+\eta$. (auth)

10477 COMMENT ON A RECENT SEARCH FOR CHARMED MESONS. Einhorn, M.B.; Quigg, C. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510). Phys. Rev. Lett. 35: No. 16, 1114-1116 (20 Oct 1975).

We assess the impact of the upper limits for production cross section times branching ratio of narrow mass peaks reported by Boyarski *et al.* on the hidden-charm interpretation of the new narrow resonances. (auth)

10478 STRONG W-PAIR MODEL AND THE Ψ PARTICLES. Marshak, R.E.; Mohapatra, R.N. (Department of Physics, The City College of The City University of New York, New York, New York 10031). Phys. Rev. D 12: No. 5, 1365-1375 (1 Sept 1975).

We propose that the two recently observed narrow resonances, ψ (3095) and ψ' (3684), be identified with the two neutral members of a U(3) triplet of W bosons, the charged member of this mediating weak interactions. The integer charge assignment of the W triplet requires it to have a nonzero triality quantum number, $t=1$. This in turn dictates that if the triplet has a strong interaction with hadrons (which have zero triality), it must be strong pair-type interaction. We then deduce that the charged W boson, which mediates the weak interactions, has mass around 4 GeV. We show that since W^* decay predominantly to hadrons this low mass is not in conflict with present experiments. We further predict that the Ψ' (3684) decays predominantly to Ψ (3095) and K^0 or 2π depending on whether the hadronic and W-bosonic SU(3) groups are identical or not. In the case of K^0 decay, limited phase space and the p-wave nature of the decay make the actual decay width of Ψ' (3684) of the order of 100 keV. On the other hand, for the 2π decay mode, the decay width is limited due to the 3-body nature of the final state. We also predict $\psi\to e\bar{e}$, $\psi'\to e\bar{e}$ coupling of the right order of magnitude in both cases. Other virtues of this model are the following: (1) it predicts the $\Delta I=1/2$ rule for nonleptonic weak decays; (2) it predicts an effective neutral-lepton-current interaction with $\Delta Y=0$ (Y is hypercharge) hadron currents comparable to the charged-lepton interaction; (3) it predicts the absence of a comparable neutral-lepton-current interaction with $\Delta Y=1$ hadron currents; and (4) it predicts a large (nuclear) cross section for W-pair production in nucleon-nucleon collisions. (auth)

10479 CHARMED NONLEPTONIC DECAY IN ASYMPTOTICALLY FREE THEORIES. Donoghue, J.F.; Holstein, B.R. (Department of Physics and Astronomy, University of Massachusetts, Amherst, Massachusetts 01002). Phys. Rev. D 12: No. 5, 1454-1458 (1 Sept 1975).

The nonleptonic decay of charmed states is studied by means of renormalization-group techniques in a class of asymptotically free models. An SU(3) sextet rule is shown to result. The enhanced piece of the Hamiltonian belongs to a 20-dimensional representation of SU(4), which distinguishes the renormalization-group approach from some alternate octet-enhancement schemes. (auth)

10480 DETERMINATION OF COUPLING CONSTANTS AND HELICITY AMPLITUDES IN DECAY PROCESSES. Lee, C.; Lee, G. (Physics Department, National Cheng Kung University, Tainan, Taiwan, Republic of China). Phys. Rev. D 12: No. 5, 1459-1464 (1 Sept 1975).

The two coupling constants and the helicity amplitudes of the decay processes [(1) a spin-J baryon decaying into a pseudoscalar meson and a spin-3/2 baryon, and (2) a spin-J boson decaying into a pseudoscalar meson and a spin-1 boson with normality opposite to that of the decaying boson] are expressed in terms of the partial-wave amplitudes. The expressions are exact, without involving any kinematical and dynamical assumptions except Lorentz invariance. The values of the coupling constants and the helicity amplitudes are then calculated for baryons of spin 3/2, 5/2, and 7/2, and for bosons of spin 1 by ignoring the high-partial-wave contribution. Under the above approximation, simple relations between the coupling constants and between the helicity amplitudes are obtained. The results are found to be exactly the same as those predicted by $SU(2)_W$ as long as $SU(2)_W$ does not forbid any helicity amplitude. (auth)

10481 $\Delta I = 1/2$ RULE IN THE PC-CONSERVING NONLEPTONIC WEAK INTERACTIONS. Becherrawy, T. (Physics Department, Faculty of Science, Lebanese University, Hadeth, Beirut, Lebanon). Phys. Rev. D 12: No. 5, 1465-1471 (1 Sept 1975).

The question of the $\Delta I = 1/2$ selection rule in weak nonleptonic decays is studied. We assume that the weak amplitudes of the form $\langle\alpha|\mathcal{H}_w|0\rangle$ obey unsubtracted dispersion relations in the momentum-transfer variable $s = p_\alpha{}^2$ and that they obey Hölder's condition in s except at possible poles. Using unitarity, the determination of the weak amplitudes is transformed into solving a Hilbert problem. This in turn is transformed into a system of Fredholm's integral equations. The number of solutions is discussed, and the solution which satisfies our assumptions is found to be unique and can be expressed in terms of the strong interaction S-matrix elements. Weak amplitudes which possess a pole, namely the PC-conserving parity-violating $\Delta I = 1/2$ interactions (poles K^0 and $\tilde{K}^0$) and the parity-conserving $\Delta I = 1/2$ interactions (poles κ^0 and $\tilde{\kappa}^0$), are shown to be consistent with our assumptions. The other ΔI amplitudes either vanish or do not satisfy unsubtracted dispersion relations. (auth)

10482 SPECTRAL-FUNCTION SUM RULES, ASYMPTOTIC SU_4, AND VECTOR-MESON LEPTONIC DECAYS. Khanna, M.P.

(Physics Department, Imperial College, London SW7, England). Phys. Rev. D 12: No. 5, 1512-1514 (1 Sept 1975).

The spectral-function sum rules corresponding to the asymptotic SU_4 symmetry are used to study the decays of the vector mesons ρ, ω, ϕ, and ψ (3105) into electron-positron pairs. The Glashow-Iliopoulos-Maiani model gives reasonable predictions. (auth)

10483 CONSEQUENCES FOR NEUTRINO PRODUCTION OF M^0 HEAVY LEPTONS. Albright, C.H. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510). Phys. Rev. D 12: No. 5, 1319-1328 (1 Sept 1975).

Monte Carlo calculations are presented for neutrino production of neutral heavy leptons which rapidly decay into dimuons and neutrinos, neutrinos only, muons and hadrons, and neutrinos and hadrons. For a mass of 4-5 GeV, the relative cross sections, branching ratios, and observed energy, x, y, and W distributions are all presently compatible with the data on dimuon production and anomalous effects recently reported. (auth)

10484 EXPECTATIONS FOR STRANGE-PARTICLE PRODUCTION BY HIGH-ENERGY NEUTRINOS. Albright, C.H. (Department of Physics, Northern Illinois University, DeKalb, Illinois 60115). Phys. Rev. D 12: No. 5, 1329-1336 (1 Sept 1975).

Inclusive strange-particle production by high-energy neutrinos through charmed-particle and heavy-lepton channels is investigated. The charm processes are discussed in the framework of the simple Weinberg-Salam gauge model, while the reactions involving heavy leptons are considered in two classes of gauge models which admit SU(2) - or SU(3) -type transitions among the leptons. Estimates obtained for associated-strange-pair-production, single-strange-particle production ($\Delta S/\Delta Q = -1$; $\Delta S = \pm 1, \Delta Q = 0; \Delta S = \pm 2$), and dileptonic processes allow one to select rather clear signatures for each production channel. (auth)

10485 SEMI-LEPTONIC WEAK AND ELECTROMAGNETIC INTERACTIONS IN NUCLEI. Donnelly, T. W. (Stanford Univ., CA). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 454-467(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

A brief summary is given of some of the work being done on the study of weak and electromagnetic processes in nuclei. The emphasis is on neutrino reactions in nuclear systems at intermediate energies--how cross sections may be predicted with some confidence and what may be learned from such studies. (JFP)

10486 NEUTRAL CURRENT PHENOMENA. Feinberg, G. (Columbia Univ., New York). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 468-485(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The definition and properties of neutral current interactions are described. Some important questions about these interactions are outlined. Some experiments proposed to test the existence and properties of neutral current interactions are discussed. These include lepton-nucleon scattering and parity violation effects in muonic atoms and heavy electronic atoms. (auth)

10487 MUONS: MUONIC ATOMS AND MUONIUM. Hughes, V. W. (Yale Univ., New Haven). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 515-540(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

A review is given of the status of knowledge of basic muon properties and interactions with particular emphasis on recent work. The topics considered include muon g-2, muonium and the muonic helium atom, muonic hydrogen and helium, and vacuum polarization in high-Z muonic atoms. (JFP)

10488 RADIATIVE PION DECAY, CURRENT COMMUTATORS, AND BARE-QUARK MASSES. Gava, E. (Univ., Trieste, Italy); Paver, N. Lett. Nuovo Cim.; 14: No. 2, 41-46(13 Sep 1975).

Starting from a recent experimental investigation of the $\pi \to l\nu\pi$ decay, it is pointed out that the information on the ratio between the axial vector and vector structure-dependent parts of the amplitude might be connected alternatively to the size of the quark masses, characterizing chiral $SU(3) \times SU(3)$ symmetry breaking in the celebrated $(3,\bar{3}) + (\bar{3},3)$ model of Gell-Mann, Oakes, and Renner. It is concluded that unless the ratio turns out experimentally to be large (of the order of 2 or so) the masses of nonstrange quarks must be very small, suggesting that chiral $SU(2) \times SU(2)$ is an almost perfect symmetry of the strong Hamiltonian. (JFP)

10489 LOW MASS HEAVY LEPTONS. Julve, J. (Univ., Bologna). Lett. Nuovo Cim.; 14: No. 3, 87-94(20 Sep 1975).

Exact calculations are performed for low heavy lepton masses, less than 1.0 GeV; the finite μ is taken into account, and two-pion or one-kaon production is considered at most. An exact expression for the $\pi\pi$ form factor is used. Two previously proposed models are considered. (JFP)

Strong (General)

Refer also to abstracts 10567, 11116, and 11118.

10490 (RL-75-148) DUALITY FOR THE REGGEON-REGGEON AMPLITUDE: A STUDY THROUGH QUASI-THREE BODY REACTIONS. Kwiecinski, J.; Roberts, R. G.; Roy, D. P. (Science Research Council, Chilton (UK). Rutherford Lab.). Sep 1975. 23p. Dep. NTIS (US Sales Only) $4.50.

Reactions of the type $ab \to cdR$ in the double Regge region are considered. The cross sections are proportional to the Reggeon-Reggeon forward amplitude in the resonance region. Using semi-local duality the cross sections can be written in terms of the relevant triple-Regge couplings which are already known from Reggeon-particle scattering, i.e., from analyzing data on reactions of the type $ah \to cR$. The predictions of $pp \to pp$ (ρ,f), $\pi^-p \to \pi^-p$ (ρ,f) are compared with data at 12, 24, and 205 GeV/c and encouraging results are found. A series of cross sections is suggested, the measurement of which will provide a definitive test of the duality hypothesis for Reggeon-Reggeon scattering. (auth)

10491 DYNAMICAL SCHEME OF MULTIPARTICLE PROCESSES. Ballestrero, A. (Univ., Turin); Predazzi, E.; Page, R. Nuovo Cim., A; 30A: No. 1, 81-92(1 Nov 1975).

Physical content is given to a multiparticle decay scheme of a fireball into pions and/or clusters of pions which was developed previously. Energy-momentum conservation coupled to the assumption of a sequential decay mode leads to a set of dynamical equations directly for physical quantities. (auth)

10492 LARGE MOMENTUM TRANSFER SCATTERING AND HADRONIC BREMSSTRAHLUNG. Blankenbecler, R. (Stanford Linear Accelerator Center, Calif. (USA)) pp 1-19 of Particles, Quantum Fields, and Statistical Mechanics. Alexanian, M.; Zepeda, A. (eds.) (Instituto Politecnico Nacional, Mexico City. Centro de Investigacion y de Estudios Avanzados). Berlin, F. R. Germany; Springer (1975).

4 figs.; 13 refs.

The interchange theory provides a simple picture of large momentum transfer scattering which correlates many features of hadrons and their interactions. It is simple to compute and has considerable predictive power. It unites the electromagnetic structure of hadrons as expressed through their form factors and inelastic structure functions with elastic and inelastic hadron-hadron scattering. The theory joins smoothly onto Regge behavior which controls forward scattering and in fact predicts such behavior. The unified description of large and small momentum transfer scattering provided by the interchange model should allow considerable insight into the interaction of hadrons and their possible composite nature. It already yields a remarkably simple quantitative description which seems valid all the way from large angle elastic scattering at 5 Gev/c to inclusive scattering at the CERN-ISR. (auth)

10493 PROCEEDINGS OF THE NINTH RENCONTRE DE MORIOND. Volume I. High Energy Hadronic Interactions. Conference Held at Meribel-les-Allues, France, March 3-15, 1974. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974). 526p. (CONF-740332-P1).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974).

Separate abstracts were prepared for the 30 papers presented. (JFP)

For abstracts of individual papers see: 10353, 10354, 10378-10383, 10406, 10424-10428, 10472, 10494, 10495, 10509-10511, 10527, 10528, 10543-10549, and 10582.

10494 REGGE BEHAVIOR IN INCLUSIVE REACTIONS AND THE CONSTITUENT INTERCHANGE MODEL. Blankenbecler, R. (Stanford Univ., CA). pp 75-94 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

The constituent interchange model together with the concept of hadronic bremsstrahlung is used as a basis for describing the Reggeization of the basic interaction mechanism. Both exclusive and inclusive scattering are discussed as well as their detailed connection in analogy with Bloom-Gilman duality. The expected behavior of the inclusive cross section throughout the entire Peyrou plot is discussed. Important corrections to the triple Regge formula are evaluated and qualitatively compared to data. Finally, the expected pattern of the final states in large transverse momentum events is qualitatively described. (auth)

10495 DIFFRACTION SCATTERING AND EXCITATIONS IN A GLUON-PHOTON ANALOGY MODEL. Dar, A.; Moriarty, K. J.; Tran Thanh Van, J. (Royal Holloway Coll., Englefield Green, Eng.). pp 249-260 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

Using the gluon-photon analogy, one obtains a model for diffraction scattering and diffraction excitation in hadron–hadron collisions. This model, which has only one free constant, the slope of the gluon trajectory, successfully reproduces the available data on elastic scattering and diffractive excitations in high energy pp collisions. (auth)

10496 LIGHT-CONE STRUCTURE IN THE CAVITY APPROXIMATION TO THE BAG THEORY. Jaffe, R.L. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139); Patrascioiu, A. Phys. Rev. D 12: No. 5, 1314-1318 (1 Sept 1975).

It is shown that the imposition of boundary conditions does not change the light-cone singularity of the free Dirac anticommutator function in three dimensions. A system of noninteracting quarks confined to a rigid cavity therefore exhibits Bjorken scaling. (auth)

10497 ABSENCE OF RESONANCES IN A CLASS OF TWO-BODY QUANTUM SYSTEMS. Zirilli, F. (Rockefeller Univ., New York). Lett. Nuovo Cim.; 14: No. 2, 60-62(13 Sep 1975).

Resonances, poles of an analytically continued resolvent, as eigenvalues of the operators $H(\theta)$, where H is the Hamiltonian of a two-body quantum system with center of mass removed, are studied in order to show the absence of resonances in a class of two-body quantum systems. (JFP)

10498 POINCARE-INVARIANT EQUATIONS WITH A RISING MASS SPECTRUM. Fushchich, V. I. (Mathematical Inst., Kiev). Lett. Nuovo Cim., 14: No. 12, 435-438(22 Nov 1975).

The Poincare-invariant motion equations with realistic mass spectra are constructed in the framework of relativistic quantum mechanics. If one imposes a certain condition on the wave function of the derived equation such an equation describes the free motion of a fixed-mass particle with arbitrary (but fixed) spin. The motion equation for two free particles with masses and spins in the Thomas–Balkamjian–Foldy form are considered. (JFP)

10499 SECONDARY CONTRIBUTIONS IN DIFFRACTIVE DISSOCIATIONS: THE "Q CROSS-OVER" PUZZLE. Cohen-Tannoudji, G.; Santoro, A.; Souza, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Service de Physique Theorique). Nucl. Phys., B; 95: No. 3, 445-460 (8 Sep 1975).

An explanation is proposed for the cross-over problem in Q and anti Q diffractive productions. It is possible to get a correct cross-over effect in the framework of a dual-reggeized-Deck-model. Unexpected features related to the phases of double-Regge exchange in $2 \to 3$ reactions are discussed. (NL)

10500 POLARIZATION PHENOMENA IN HIGH ENERGY NUCLEAR INTERACTIONS. Lapidus, L. I. (Joint Inst. for Nuclear Research, Dubna, USSR). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 129-154(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The review of polarization phenomena in high energy nuclear interactions includes new results on the spin dependence of hadron-hadron interactions at high energies and a discussion of polarization effects in high energy particle interactions with nuclei. It is shown clearly that spin dependence remains in amplitudes of interactions at the level of (5 to 10 percent) up to the highest particle energies reached at modern accelerators. (JFP)

10501 IMPLICATIONS OF PARITY VIOLATING EFFECTS IN STRANGENESS CONSERVING NONLEPTONIC PROCESSES. Herczeg, P. (Los Alamos Scientific Lab., NM). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 504-514(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The information one obtains from the various experimental results regarding the question of the origin of parity-violating effects in strangeness-conserving nonleptonic processes is discussed, and some theoretical ideas are reviewed that have recently been discussed in this connection. (JFP)

10502 HADRONIC ATOMS. Tauscher, L. (Univ., Basel). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 541-562(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Recent results on the masses of the pi$^-$, K$^-$, anti p, and SIGMA$^-$, as well as on the magnetic moments of the anti p and SIGMA$^-$, are presented. The strong hadron-nucleus interaction is discussed for pi$^-$, K$^-$, and anti p. Especially, the influence of precision measurements of light pionic atoms on the understanding of the pi$^-$-nucleus s-wave interaction is pointed out. New measurements on deformed nuclei with pions are discussed in terms of the quadrupole deformation of the neutron distribution. The difficulties in understanding the K$^-$-nucleus interaction are demonstrated. Recent measurements on light anti p atoms are reported, in particular the first observed isotope effect in anti p atoms ($^{16}O/^{18}O$) is discussed in terms of differences in the anti pn and anti pp interaction. (auth)

Strong (Baryon No. = 0)

Refer also to abstract 10565.

10503 (JINR-E2-9129) EXACT SATURATION AND DEGENERACY OF ISOSPIN BOUNDS AND ZEROS TRAJECTORIES IN PION–NUCLEON SCATTERING. Ion, D. B. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 41p. Dep. NTIS (US Sales Only) $5.00.

The exact saturation and degeneracy of the isospin bounds, in terms of the zeros trajectories (ZT) of $\mathrm{Im}N_{ij}$ [N_{ij} -specific bilinear forms], are systematically discussed. The topology of the zeros trajectories and near degeneracy of the isospin bounds in the pion-nucleon scattering are investigated using the CERN-theoretic[6] and CERN experimental[7] solutions for the phase shifts. The interpretation of the experiments in terms of (ZT)-topology as well as certain tests for the possible isospin breaking phenomena are suggested. (auth)

10504 SOMMERFELD–WATSON REPRESENTATION FOR DOUBLE-SPECTRAL FUNCTION. II. Crossing Symmetric Pion–Pion Scattering Amplitude Without Regge Poles. Frederiksen, J. S. (Australian National Univ., Canberra. Research School of Physical Sciences). Commun. Math. Phys.; 43: No. 1, 1-16 (1975).

9 refs.

We discuss, for the case of pion–pion scattering, a closed system of equations which may be used for self-consistent calculation of partial-wave amplitudes. It is shown that, for a given sufficiently small input function, the equations have a locally unique solution in a particular Banach space of doubly Hoelder continuous partial wave amplitudes. At a fixed point, the scattering amplitude is shown to satisfy both a crossing symmetric unsubtracted Mandelstam representation and the elastic unitarity condition. In this initial study the partial-wave amplitudes are holomorphic in the right half complex angular-momentum plane. (auth)

10505 POSSIBLE INCOMPATIBILITY BETWEEN THE NN AND ANTI NN TOTAL CROSS SECTIONS AND THE REGGE-POLE MODEL. Bouquet, A. (Univ., Paris); Diu, B.; Leader, E.; Nicolescu, B. (Univ., Paris). Nuovo Cim., A; 29A: No. 1, 30-40(1 Sep 1975).

The measurements of NN and $\bar{N}N$ total cross sections at high energies show unexpected behavior for cross section differences. ρ-A_2 exchange degeneracy seems to fail completely at FNAL energies. In analyzing this effect one is led to question the procedure used at Serpukhov and FNAL to obtain neutron cross sections from deuterium data. Starting from what appears to be a reasonable phenomenological hypothesis concerning the Glauber correction, one solves an incompatibility between the Serpukhov and FNAL data. At the same time, the above-mentioned effect is strongly reinforced, and is seen to originate in a non-Regge behavior of the $\ll A_2 \gg$ contribution, which changes sign around $p_L = 40$ GeV/c. Such an unexpected behavior could be due to a new term, small at lower energies but which asymptotically dominates over the Regge pole. (auth)

10506 PRODUCTION OF THE NEW RESONANCES IN HADRONIC COLLISIONS. Green, M. B. (Cambridge Univ., Eng.); Jacob, M.; Landshoff, P. V. Nuovo Cim., A; 29A: No. 1, 123-139(1 Sep 1975).

The variation with energy and with Feynman's variable x of the production of Ψ and Ψ' is a sensitive test of their production mechanism. A simple parton model predicts that at relatively low energies production near $x = 0$ is strongly favored and that the invariant cross section at $x = 0$ increases by two orders of magnitude between BNL and ISR energies. A sharp increase is also predicted for the ratio of Ψ or Ψ' production to the nonresonant lepton pair background. (auth)

10507 STUDY OF THE POSSIBLE EXISTENCE OF RHO′ AND RHO″. Alles-Borelli, V.; Bernardini, M.; Bollini, D. (CERN, Geneva). Nuovo Cim., A; 30A: No. 1, 136-143(1 Nov 1975).

The possible existence of new vector mesons above the ρ is investigated. The conclusion is that the data are compatible with the existence of the ρ'-meson only if one assumes, as a firm theoretical prediction, the Gounaris-Sakurai tail of the standard ρ-meson. Furthermore the data are compatible with the existence of the ρ''-meson if one assumes the validity of the $\bar{p}p$ model for the calculation of the multihadron cross section. (auth)

10508 QUARK MODEL RELATIONS BETWEEN ρ^0 AND ω PHOTOPRODUCTIONS. Hayashi, M.; Katsuura, K. (Saitama Medical Coll., Japan). Nuovo Cim., A; 30A: No. 1, 126-135 (1 Nov 1975).

To describe the ρ^0 and ω photoproductions the pseudomodel is proposed in which the quark model of photoproduction is supplemented with the well-established observations that the pomeron contributions are dominant in the ρ^0 photoproduction and that the one-pion exchange as well as the pomeron are important contributors in the ω photoproduction. A number of relations as well as inequalities between ρ^0 and ω photoproductions are derived. It is shown that these relations are in overall satisfactory agreement with the available data. (auth)

10509 PRODUCTION MECHANISMS FOR HIGH MASS RESONANCES. Michael, C. (CERN, Geneva). pp 147-152 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

For a sequence of resonance states of increasing spin and mass which lie on a given Regge trajectory, the two-body production mechanisms are compared. Duality provides relations between the respective couplings and an explicit dual model vertex structure is shown to relate $\pi N \to \rho N$ and $\pi N \to f_0 N$ amplitudes. (auth)

10510 RECENT RESULTS ON MESON RESONANCES AND POSSIBLE EXPERIMENTS AT HIGH ENERGY. Miller, D. H. (Purdue Univ., West Lafayette, IN). pp 161-170 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

The study of exclusive channels at high energies may be as important as it was at lower energies. As an example current problems in meson spectroscopy are reviewed, and experiments are suggested for higher energies. (auth)

10511 HIGH ENERGY INFORMATION FROM NUCLEON-ANTINUCLEON ANNIHILATION AT REST. Pelaquier, E. (Laboratoire de Physique Mathematique, Montpellier, France). pp 493-504 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

The description of $\bar{N}N$ annihilation at rest in a model which involves only quasi – 2 body decays gives the main features of the charged pions' experimental spectra and predicts some unknown spectra (π^0, ρ, ω). An attempt is made to describe the projectile's fragmentation part in inclusive reactions using the $\bar{N}N$ system as a prototype of a heavy meson. One can also obtain the valence part of the hadron structure function in the deep-inelastic scattering by assuming the $\bar{N}N$ decay into pions to be a picture of some meson's fragmentation in its constituents, for instance partons. (auth)

10512 COMMENTS ON STRONGLY INTERACTING *W*-MESON THEORIES. Segrè, G. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19174). Phys. Rev. D 12: No. 5, 1499-1501 (1 Sept 1975).

We discuss the phenomenology and possible neutral-current tests of theories in which the *W* mesons have strong as well as semiweak and electromagnetic interactions. We then show that, at least in one such model, divergence difficulties are still present in the usual way for amplitudes such as $K_L \to \mu^+\mu^-$. (auth)

10513 THE MASS OF THE ψ (3095) AS AN $N\bar{N}$ RESONANCE. Mac Gregor, M.H. (Lawrence Livermore Laboratory, Livermore, California 94550). Phys. Rev. D 12: No. 5, 1492-1494 (1 Sept 1975).

Guided by a suggestion that the ψ (3095) is an $N\bar{N}$ resonance, and using the basis states of a previously published light-quark model, we "calculate" the mass of the ψ as 3105_{-15}^{+5} MeV. The appearance of a narrow-width meson resonance at this mass value is consistent with a systematic formalism that was devised to generate the observed spectrum of lower-mass narrow-width meson resonances. However, the width of the ψ is narrower by a factor of $\alpha^{-1}=137$ than we would have anticipated on the basis of the light-quark model. The ψ' (3684) resonance also fits into this formalism, but the mass of the ψ' has a larger calculational uncertainty since it is above the $N\bar{N}N\bar{N}$ threshold. (auth)

10514 SPECTRUM OF STRANGE-QUARK–ANTIQUARK BOUND STATES. Lichtenberg, D.B.; Wills, J.G. (Physics Department, Indiana University, Bloomington, Indiana 47401). Phys. Rev. Lett. 35: No. 16, 1055-1059 (20 Oct 1975).

A calculation is made of the energy levels of the bound states of a strange quark and its antiquark with an interaction which includes an attractive Coulomb potential term, a confining linear potential, and spin-orbit, quadratic-orbit, spin-spin, and quadratic-spin interactions. Good agreement is obtained with observed mesons, and the existence of other mesons is predicted. (auth)

10515 BROKEN-MASS SOLUTIONS TO SUPERCONVERGENCE RELATIONS. Neville, D.E. (Department of Physics, Temple University, Philadelphia, Pennsylvania 19122). Phys. Rev. D 12: No. 5, 1382-1403 (1 Sept 1975).

We use an ansatz motivated by duality and the quark model to saturate superconvergence relations near $t=0$ for scattering of mesons in the vector and pseudoscalar nonets. The saturation is carried out with a few low-lying states, using the observed mass spectrum rather than the degenerate masses characteristic of a nonet—or SU(6) —symmetric model. (auth)

10516 CURRENT-ALGEBRA THEOREMS FOR $K\pi$ SCATTERING. Boal, D.H.; Graham, R.H.; Weisman, B. (Department of Physics, University of Toronto, Toronto, Ontario, Canada). Phys. Rev. D 12: No. 5, 1472-1487 (1 Sept 1975).

On-mass-shell current-algebra sum rules for $K\pi$ scattering are investigated. At threshold these sum rules relate the combinations $a^{1/2}-a^{3/2}$ and $a^{1/2}+2a^{3/2}$ of $I=1/2$ and $3/2$ S-wave scattering lengths to their soft-meson predictions plus "correction" terms. A dispersion-theoretic approach is used to calculate the corrections to both the soft-koan and soft-pion values for each of these scattering length combinations. The dispersion relations are assumed to be dominated by the K^* (890) and a $J^P=0^+\kappa$ meson. The correction to the soft-pion value $a^{1/2}-a^{3/2}=0.210m_\pi^{-1}$ is found to be very small, thus suggesting that the on-mass-shell current-algebra prediction for $a^{1/2}-a^{3/2}$ is nearly equal to the soft-pion value. Self-consistency requirements of the analysis favor $F_K/F_\pi \simeq 1.22$; this implies that a fairly large (~30%) correction to the corresponding soft-koan prediction of $a^{1/2}-a^{3/2} \simeq 0.14m_\pi^{-1}$ is needed. The K^* and κ contributions to the latter correction increase this value to $0.177m_\pi^{-1}$. Furthermore, since the K^* and κ corrections to and the soft-koan value of $a^{1/2}-a^{3/2}$ decrease with increasing F_K/F_π, a value of $F_K/F_\pi \gtrsim 1.3$ seems, at least in the context of the present study, to be rather unlikely. (auth)

10517 ANTINUCLEON–NUCLEON SYSTEM AT NONRELATIVISTIC ENERGIES. Kalogeropoulos, T. E. (Syracuse Univ., NY). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 155-171(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

One first points out the connection between NN and N anti N. This connection implies many bound and resonant states with widths which are very sensitive to the details of the nucleon core. Reasonable core boundary conditions may produce in principle very narrow (certainly much smaller than the unobstructive widths which are approximately equal to m/sub pi/) high spin states. One then discusses experimental results which directly or indirectly favor the existence of narrow N anti N bound and resonant states. (auth)

10518 HIGH ENERGY COHERENT REACTIONS WITH NUCLEAR TARGETS. Rosen, J. L. (Northwestern Univ., Evanston, IL). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 265-288(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

A review of high energy coherent reactions with nuclear targets is given. It is primarily addressed to nonspecialists in high energy reaction work. The various reaction channels are classified according to the type of exchange quanta, and selected new experimental work is presented so as to illustrate the nature and utility of these reactions. (auth)

10519 NEW PARTICLES. Gilman, F. J. (Stanford Univ., CA). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 331-350 (1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The properties of the new particles are reviewed in the context of the behavior of electron-positron annihilation into hadrons.

The phenomenology of psi (3100) and psi (3700) decays is discussed in some detail with emphasis on what the decays allow one to infer about the resonances, and on the difficulties which the observation and, more critically, the nonobservation of certain modes causes possible theories. (auth)

10520 FRAGMENTATION OF RELATIVISTIC NUCLEI. Cork, B. (Univ. of California, Berkeley). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 598-620(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Nuclei with energies of several GeV/n interact with hadrons and produce fragments that encompass the fields of nuclear physics, meson physics, and particle physics. Experimental results are now available to explore problems in nuclear physics such as the validity of the shell model to explain the momentum distribution of fragments; the contribution of giant dipole resonances to fragment production cross sections; the effective coulomb barrier nuclear temperatures. A new approach to meson physics is possible by exploring the nucleon charge exchange process. Particle physics problems are explored by measuring the energy and target dependence of isotope production cross sections, thus determining if limiting fragmentation and target factorization are valid, measuring total cross sections to determine if the factorization relation, sigma^2/sub AB/ equals sigma/sub AA/ . sigma/sub BB/ is violated. Also, new experiments were performed to measure the angular distribution of fragments that could be explained as nuclear shock waves and to explore for ultradense matter produced by very heavy ions incident on heavy atoms. (auth)

10521 ISOSPIN ANALYSIS OF ANTI NN → ANTI NNπ REACTIONS AT 5.7 GeV/c. Braun, H.; Gerber, J.-P.; Maurer, G.; Michalon, A.; Schiby, B.; Strub, R. (Strasbourg-1 Univ., 67 (France)); Strachman, Z. (Paris-6 Univ., 75 (France). Lab. de Physique Nucleaire et de Hautes Energies). Nucl. Phys., B; 95: No. 3, 503-515(8 Sep 1975).

A cross-channel isospin analysis has been performed on the channels anti pN → anti N(Nπ) and anti pN → N (anti Nπ) in terms of three isospin amplitudes $M^0_{\frac{1}{2}}$, $M^1_{\frac{1}{2}}$ and $M^1_{\frac{3}{2}}$ where the upper index is the isospin of the exchanged "object" in the t-channel and the lower index is the isospin of the (Nπ) or (anti Nπ) system. Enhancements are observed in the low (Nπ) invariant mass region for an $I = \frac{1}{2}$ final state when the isospin of the exchanged object in cross channel is $I_E = 0$ and 1. (NL)

10522 HADRON DYNAMICS AND PARTON HYPOTHESIS. Patashinskii, A. Z. (Inst. of Nuclear Physics, Moscow). Yadern. Fiz.; 22: No. 1, 198-206(Jul 1975). (In Russian).

Dynamics of hadron collisions with hadrons and nuclei at high energies is investigated qualitatively in terms of the parton model under the assumption of strong interaction changing the parton number in the evolution process. The inclusive spectrum having the central part rising with the energy is obtained. The hadron-nucleus collision is considered and formulas for the inclusive spectrum in this case are obtained. Possible parton structure of the hadron is discussed. The scaling hypothesis in the field theory is formulated. (auth)

10523 K^0_1 K^0_1 THRESHOLD EFFECT AND $\pi\pi$ INTERACTION. A Phenomenological Approach. Brenzikofer, R. (Univ., Neuchatel, Switzerland); Bogdanski, M.; Jeannet, E.; Vuillemin, V. Lett. Nuovo Cim.; 14: No. 12, 439-442(22 Nov 1975).

A phenomenological model is proposed which predicts both the shape and cross section values of a threshold enhancement in the K^0_1 K^0_1 mass spectrum in the reactions $\bar{p}p \to K^0_1K^0_1m\pi(m = 2.3)$, $\pi^-p \to K^0_1K^0_1n$, and $K^-N \to K^0_1K^0_1y$. The proposed mechanism is based on the reaction $\pi^+\pi^- \to K\bar{K}$ occurring as an I = 0, S-wave final-state interaction. This threshold effect is computed for the studied reactions, and the cross sections found are seen to be suitably reproduced on a wide momentum range for the first two reactions. (JFP)

10524 ORTHOCHARMONIUM AND $\psi \to$ ANTI HH. Ravndal, F. (NORDITA, Copenhagen). Lett. Nuovo Cim., 14: No. 12, 432-434(22 Nov 1975).

The ψ particles can be bound states of a charmed quark and its antiquark, forming orthocharmonium when the total quark spin equals S = 1. States with orbital angular momentum L = 0 then have quantum numbers $J^{PC} = 1^{--}$ and negative G parity. This seems to be consistent with the present experimental situation for the $\Psi(3095)$ and $\Psi(3685)$. Hadronic decays of these particles can then proceed through a virtual photon or through intermediate gluons. From the known decay rates one can conclude that these two amplitudes might be of the same order of magnitude. The full decay amplitudes for the octet baryons are found. It is noted that these results are independent of the explicit orthocharmonium model for the ψ particles. (JFP)

10525 UNIVERSALITY OF THE QUARK ORBITAL EXCITATION MASS LEVEL AND THE BREAKING OF SU_4 SYMMETRY. Matsuda, M.; Tanimoto, M. (Hiroshima Univ.). Lett. Nuovo Cim.; 14: No. 2, 47-52(13 Sep 1975).

The possibility is examined that the mass spectrum of the hadrons is due to the excitation of the internal angular momentum among the urbaryons. The meson and baryon mass spectra are predicted. It is found that the slope of the hadron trajectory is not universal. (JFP)

Strong (Baryon No. = 1)

10526 (GIFT-10/75) EVOLUTION OF LOCALIZED DISTURBANCES TO STATIONARY STATES IN A NONLINEAR PROTON MODEL. Soler, M. (Junta de Energia Nuclear, Madrid (Spain)). 1975. 30p. Dep. NTIS (US Sales Only) $4.00.

Numerical solutions were obtained for the time-dependent equation of a nonlinear spinor field having electromagnetic interactions. They show the evolution of arbitrary initial states to stationary solutions previously considered to describe the baryons. Within this model, shapes very close to the stationary are reached in time periods of the order of 10^{-23} sec. (auth)

10527 DUALITY IN REGGEON–PARTICLE SCATTERING. Estabrooks, P. (Durham Univ., Eng.). pp 153-160 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

Results of duality tests as applied to Reggeon–particle scattering in $\pi^-p \to \pi^-\pi^+n$ are presented. The implications of these and other quasi-two-body results for high energy multiparticle production mechanisms are discussed. (auth)

10528 SPIN-PARITY STRUCTURE OF THE ($K^-\pi^+$) AND ($K^-\pi^+\pi^-$) SYSTEMS PRODUCED IN CHARGE EXCHANGE REACTIONS. Aachen-Berlin-CERN-London-Vienna and Athens-Democritus-Liverpool-Vienna Collaboration. pp 171-190 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

Partial wave analyses were performed for the ($K^-\pi^+$) and ($\bar{K}^0\pi^+\pi^-$) systems produced in the reactions $K^-p \to K^-\pi^+n$ and $K^-p \to \bar{K}^0\pi^+\pi^-n$, respectively. It is found that the S-wave ($K^-\pi^+$) system is consistent with a Breit-Wigner shape peaked at 1.3 and 0.6 GeV wide. The low mass ($K^0\pi^+\pi^-$) system composed mainly of $J^P = 0^-$, 1^+ and 2^+ states, resembles in its structure the $(K\pi\pi)^-$ system produced in diffractive reactions. This implies, in particular, that the presence of unnatural spin-parity states produced by natural parity exchanges cannot be considered as an exclusive characteristic of diffractive processes. A method of analyzing the (Nπ) systems is described. (auth)

10529 MONTE CARLO METHOD FOR INCLUSIVE PROCESSES AT A 40 GeV/c MOMENTUM. Kopylov, G. I.; Penev, V. N.; Shklovskaya, A. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Bulg. J. Phys.; 2: No. 2, 98-105(1975). (In Russian)

The Monte Carlo method can be applied to inclusive reactions if one considers them as a sum of exclusive reactions each one being simulated by existing programs (FORS, FOWL, MULTIFORS). The reaction $\pi p \to \pi$ + anything at 40 GeV/c is stimulated. It is assumed that each reaction $\pi p \to N + n\pi$ (n = 1 to 18) can be described by multiperipheral diagrams, the program MULTIFORS being used to simulate them. The diagrams are added with weights which are proportional to the experimentally observed multiplicities (of the charged particles plus the mean number of neutral particles). The sign of the mesons has not been taken into account. The results are compared with experimental data and discussed. (auth)

10530 ASYMPTOTIC SCALING LAW FOR INCLUSIVE PRODUCTION IN QUARTET QUARK MODEL. Iwao, S. (Kanazawa Univ., Japan). Lett. Nuovo Cim.; 14: No. 1, 1-7(6 Sep 1975).

A new scaling law is constructed which accommodates the observation that about one-third of the pions are decay products of rho mesons in π^-p interactions at 205 GeV/c as well as available information including ψ particle inclusive production, without damaging appreciably the good aspects of the old scaling law in terms of the quartet version of the quark model. The physical significance of the asymptotic scaling law in the new version is also discussed. (JFP)

10531 NUCLEON EXCHANGE IN THE γ_5 THEORY. Perlovskii, L. I. (Novosibirsk State Univ., USSR). Yadern. Fiz.; 22: No. 1, 207-217(Jul 1975). (In Russian).

Studying the asymptotics of ladder diagrams of the πN backward scattering, a model is built which seems to be able to describe the amplitudes at high energies. The model involves the Regge poles, the immovable root branching points and an elementary nucleon. The phenomenology is briefly discussed in the framework of the model under consideration. (auth)

10532 ISOBARS IN NUCLEI. Beurtey, R. (CEN de Saclay, Gif-sur-Yvette, France). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 653-665(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The present situation of the theoretical studies and experimental material concerning the potential presence of virtual nucleon excited states (isobars) in nuclei is reported. Three particular aspects are examined: the theoretical work devoted to the isobar content of nuclei (especially the deuteron), the experimental material concerning isobar exchange and the attempts to obtain direct evidence for such objects in the deuteron (spectator method). (auth)

Strong (Baryon No. ≥ 2)

10533 (JINR-E2-9218) TRIPLE REGGE PHENOMENOLOGY IN THE REACTION p + p → p + X. Kazarinov, Yu. M.; Kopeliovich, B. Z.; Lapidus, L. I.; Potashnicova, I. K. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 33p. Dep. NTIS (US Sales Only) $5.00.

The statistical analysis of the data on the reaction p + p → p + X in the region $|t| < 0.6$ $(GeV/c)^2$ and $x \geq 0.85$ is performed. All the triple Reggeon contributions, including the interference terms, were taken into account. Two sets of the parameters, describing the triple Regge vertices are founded. To explain a deviation from the experimental s-dependence at low energy and x-dependence at $x < 0.85$ some mechanisms, omitted in the analysis, are proposed. A comparison with one pion exchange model predictions shows a good agreement. Some reactions, useful for further triple Regge vertex investigations and cut contribution revealing, are discussed. (auth)

10534 (JINR-P2-9150) GLAUBER CORRECTION AND FINAL STATE INTERACTION IN REACTIONS OF TYPE $\pi^+d \to K^+YP$. Lykasov, G. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The reactions of the type $\pi^+d \to K^+Yp$ at high energies ($T \geq 1$ GeV) and small angles of scattered K^+ - mesons are considered. The role of the interaction of particles Y, P in final state in these reactions is analyzed. It is shown that the interaction contribution Y−P to the differential cross section $d\sigma/d\Omega$ decreases the Glauber effects of the rescattering of π^+ or K^+-mesons on the nucleons of the deuteron. This contribution of the final state interaction σ depends essentially on the resolution of the detecting device. At some resolution on the effective mass of Y−P system the Glauber correction is nearly compensated by the value σ. In addition, the question of whether hadron deuteron breakup reaction final-state interaction (FSI) effects give a large contribution to the differential cross section $d\sigma/d\Omega$ is discussed. It is shown that if the S-wave length of the interacting particles in the final state is compared with $1/\Delta$, then the contribution of FSI to $d\sigma/d\Omega$ can compensate the Glauber correction. (auth)

10535 (LYCEN-75-02, pp 1-6 (Pt.C4)) REGGE POLE THEORY AND α-PARTICLE SCATTERING. Ceuleneer, R. [nd]. (In French).

From 3rd biennial session on nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10−15 February 1975. (Lyon-1 Univ., 69 − Villeurbanne (France). Inst. de Physique Nucleaire).

The Regge formalism is applied to the elastic scattering of alpha-particles by nuclei. The introduction of a background beside the pole terms is discussed. (FR)

10536 (LYCEN-75-02, pp 1-22 (pt. C14) NUCLEON−NUCLEON INTERACTION AT LOW AND MEDIUM ENERGIES. Vinh Mau, R. [nd]. (In French).

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire).

The present status of the nucleon−nucleon interaction is reviewed. Phenomenological models and one-boson-exchange models are discussed. Special emphasis is given to the dispersion relation approach which permits a global correlative analysis of the πN, ππ and NN interactions. (FR)

10537 (LYCEN-75-02, pp 1-35 (Pt.C17)) OBSERVABLES IN NUCLEON−DEUTERON ELASTIC SCATTERING. Fayard, C.; Lamot, G. H.; Elbaz, E. [nd]. (In French).

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10−15 February 1975. (Lyon-1 Univ., 69 − Villeurbanne (France). Inst. de Physique Nucleaire).

A review of the theoretical observables in N-d elastic scattering up to 40 MeV (differential cross sections, vector and tensor polarizations, spin correlation coefficients, phase-shift analysis) as obtained previously when using separable N-N interactions is given. (FR)

10538 (LYCEN-75-02, pp 1-10 (Pt.S5)) ATTEMPT OF DIRECT RECONSTRUCTION OF THE pp SCATTERING MATRIX BELOW 500 MeV. Giffon, M. [nd]. (In French).

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69 − Villeurbanne (France). Inst. de Physique Nucleaire).

The possibilities to use available experimental data to reconstruct the pp scattering matrix in three energy ranges below 500 MeV are studied. This problem can be solved using a minimization technique. A numerical evaluation of the various amplitudes and of their angular and energetic dependences is obtained. An estimate of missing experimental data is given. The results are sometimes different from the phase shift analysis ones. The discrepancy is possibly due to the uncertainties on the measured quantities and the way they are handled. In the future, taking into account the relativistic corrections necessary for an investigation at higher energy, phase shifts from the results obtained more directly than usual are expected. (FR)

10539 (PUC-TN-11/74) INFLUENCE OF KINEMATICAL AND DYNAMICAL OFF-MASS-SHELL EXTENSIONS IN DEUTERON BREAKUP NEAR A RESONANCE. Ferreira, E.; Rosa, L. P.; Thome, Z. D. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil)). Aug 1974. 11p. INIS.

Presented at the symposium Theory of Lightest Nuclei, Czechoslovakia, 28 May−1 June 1974.

The $\pi d \to \pi np$ reaction near the P33 resonance is analyzed. The kinematical and dynamical effects of the off-mass-shell extensions of the matrix elements are discussed and the main features of the results obtained previously with extensive numerical computation are explained qualitatively. (auth)

10540 (USIP-75-11) INVESTIGATION OF CLUSTERING EFFECTS IN THE REACTION $pp \to pp\pi^+\pi^+\pi^-\pi^-$ AT 19 GeV/c. Allan, J.; Blomqvist, G. (Stockholm Univ. (Sweden). Fysiska Institutionen). Jul 1975. 57p. Dep. NTIS (US Sales Only) $4.50.

Possible production of high multiplicity clusters of secondaries in the reaction $pp \to pp\pi^+\pi^+\pi^-\pi^-$ at 19 GeV/c is investigated. The experimental distribution of dispersion versus mean for the pion rapidities shows, compared to simple one component models, an excess of events in the regions where a single diffraction dissociation process is expected to populate. A method based on the Cramer von Mises statistical test combined with an operational method for selection of quasi two body reactions is used for investigation of clustering effects in phase space caused by different reaction mechanisms. The analysis indicates that the distribution of experimental events in phase space has mainly two population centers, one consisting of events with the kinematical configuration expected from a single diffraction dissociation process. Results from application of various methods for selection of quasi two body reactions are compared with similar investigations at other incoming momenta. A comparison with the reactions $\pi^+p \to p\pi^+\pi^+\pi^+\pi^-\pi^-$ at 16 GeV/c shows that the samples of single diffraction like events fulfil the factorization property. (auth)

10541 SOME RESULTS ON STRONG INTERACTION IN HIGH ENERGY PHYSICS. Dau, W. D. (Kiel Univ. (F. R. Germany). Inst. fuer Reine und Angewandte Kernphysik). Atomkernenergie; 26: No. 1, 1-6(1975). (In German)

15 figs.; 1 tab.; 20 refs.

Some essential results in the field of strong interaction in high energy physics are presented. These results have been obtained from experiments at proton accelerators over the past three years. (auth)

10542 REVIEW OF RESULTS OBTAINED AT THE CERN INTERSECTING STORAGE RINGS. Amaldi, U. (European Organization for Nuclear Research, Geneva (Switzerland)). pp 445-472 of Trends in Elementary Particle Theory. Rollnik, H.; Dietz, K.

(eds.) (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Berlin; Springer (1975).

15 figs.; 1 tab.; 21 refs.

In this experimental review, after a short presentation of the Intersecting Storage Rings (Section 2), a summary is given in Section 3 of the information obtained at this machine during the years 1971-1973, i.e., in the first-generation experiments. Section 4 is devoted to some of the latest experimental results, while Section 5 contains a list of experiments which are at present under way or will be running in 1975. (auth)

10543 DO PRESENT EXPERIMENTAL DATA DETERMINE THE TRIPLE POMERON COUPLING AT t = 0. Siotis, I. (Imperial Coll. of Science and Tech., London). pp 269-274 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

It is shown that, contrary to a common belief, all present experimental data on $pp \to pX$ are consistent with a triple Pomeron coupling which vanishes as t tends to zero. (auth)

10544 COMMENTS ON DIFFRACTION PROCESSES AND TOTAL CROSS SECTIONS. Morrison, D. R. O. (CERN, Geneva). pp 275-297 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

Some controversial aspects of diffraction dissociation are discussed in the light of some recent results. Evidence is presented that the A_1, A_3, Q and L mass enhancements are not single resonant states and that an N*(1400) is not required. It is suggested that the cross section for diffraction dissociation is almost equal to that for diffraction elastic scattering and both are slowly rising as does the total inelastic cross section, i.e., as $s^{+\,0.04}$ or $(\log s)^{+\,0.4}$. The Reggeon exchange part of pp elastic scattering then falls as s^{1}. (auth)

10545 DIFFRACTIVE SCATTERING AND MODELS FOR RISING CROSS SECTION. Capella, A. (Paris Univ., Orsay, France). pp 299-316 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

The proton inclusive spectrum in the diffractive region is described by a PPP term, obtained from resonance production data at conventional accelerator energies via finite mass sum rules, with no free parameter. This term gives a contribution to $\sigma_{\text{inel}}^{pp}$ which increases with s in a way consistent with experiment. It is also shown that the Gribov's reggeon calculus does not seem to be a good candidate to describe physics at ISR energies. (auth)

10546 S-CHANNEL MODELS FOR THE POMERON. Peccei, R. D. (Rutherford Lab., Chilton, Eng.). pp 317-338 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

Various difficulties of recent s-channel models for the Pomeron are discussed. It is shown how some of these difficulties can be overcome where one introduces a dynamical mechanism for generating the triple Pomeron zero and/or includes absorptive effects. (auth)

10547 DIFFRACTIVE DISSOCIATION AS SHADOW OF HADRONIC BREMSSTRAHLUNG. Bialas, A. (Max-Planck-Institut fuer Physik und Astrophysik, Munich). pp 353-361 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

A summary of work on the mechanism of diffraction dissociation from nucleons and from nuclei, written recently in collaboration with A. Kotanski and W. Czyz, is presented. (auth)

10548 IMPACT STRUCTURE OF DIFFRACTION SCATTERING. Miettinen, H. I. (CERN, Geneva). pp 363-402 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

Some recent progress in the impact analysis of elastic and inelastic diffraction is discussed. Remarks are made on some theoretical explanations of the total cross section rise. (auth)

10549 NUCLEON–ANTINUCLEON PRODUCTION AS THE CAUSE OF σ_{pp}^{tot} RISE AT ISR. Tan, C. I. (Brown Univ., Providence). pp 451-472 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

The suggestion that the rise of σ_{pp}^{tot} at ISR is due to the production of nucleon–antinucleon pairs is reviewed. Various techniques for estimating the $N\bar{N}$ cross section are discussed. It is explained why the increase in $N\bar{N}$ production is not cancelled by a corresponding decrease in the rest of the nondiffractive cross section. Phenomenological consequences of the conjecture are provided. The phenomenon of "bare Pomeron renormalization" is clarified. (auth)

10550 NONPERTURBATIVE THREE-DIMENSIONAL FORMALISM FOR THE STUDY OF THE NUCLEON-NUCLEON INTERACTION. Klein, A. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19174); Lee, T.H. Phys. Rev. C 12: No. 5, 1381-1391 (Nov 1975).

As an alternative to the dispersion theoretic approach to the two-nucleon interaction, we outline an improved version of an older method which derives both an interaction and the wave equation of which it is a part on an equal footing. This is done by reducing the Bethe-Salpeter equation to an equal time equation. The main improvement is that the interaction is given in nonperturbative form rather than as a sum of Feynman diagrams. As an illustration of the formalism, we test the validity of a simple version of the isobar model for the nucleon-nucleon problem and find it quantitatively inadequate. We discuss parenthetically how the existence of classes of reduction schemes is reflected as an ambiguity in the definition of the interaction. (auth)

10551 NEW SEMIPHENOMENOLOGICAL SOFT-CORE AND VELOCITY-DEPENDENT NUCLEON-NUCLEON POTENTIAL. Lacombe, M.; Loiseau, B.; Richard, J.; Vinh Mau, R. (Division de Physique Théorique, Institut de Physique Nucléaire, Paris, France Pires, P.; de Tourreil, R. Phys. Rev. D 12: No. 5, 1495-1498 (1 Sept 1975).

A nucleon-nucleon potential is constructed which possesses fundamental theoretical long- and medium-range parts. The short-range part is determined phenomenologically by fitting the phase parameters as well as the deuteron properties. Although the number of free parameters is small (six in each isospin state) the quality of the fit is very good. (auth)

10552 PHENOMENOLOGICAL THEORY OF PRODUCTION REACTIONS. Klink, W.H. (Department of Physics and Astronomy, The University of Iowa, Iowa City, Iowa 52240). Phys. Rev. D 12: No. 5, 1337-1344 (1 Sept 1975).

A phenomenological theory of production reactions is presented in which crossing and unitarity are used to connect different production amplitudes. The theory is developed as an approximation scheme, in which at each stage of the approximation exact unitarity is enforced. (auth)

10553 PRODUCTION OF PARTICLES CONTAINING CHARMED QUARKS IN HADRONIC COLLISIONS. Gunion, J.F. (Department of Physics, University of Pittsburgh, Pittsburgh, Pennsylvania 15260). Phys. Rev. D 12: No. 5, 1345-1355 (1 Sept 1975).

The ability to obtain the correct cross section for production of the new 3.1-GeV resonance at Brookhaven National Laboratory using the natural analog of the Drell-Yan annihilation mechanism leads us to explore further implications of this approach. We present in detail the longitudinal- and transverse-momentum dependence of the cross section, as well as its dependence upon beam energy. We point out correlations among final-state multiplicity, longitudinal momentum of the resonance, and resonance mass peculiar to the parton-model annihilation mechanism. We also examine the alterations which are expected upon employing a $\bar{p}$ beam. Finally, we obtain cross sections for charmed meson and baryon production. $\bar{D}^{0*}$ and D^{-*} mesons should have particularly large production cross sections. (auth)

10554 HIGH ENERGY HADRON COLLISIONS IN CLUSTER MODELS. Ugaz, E. Austin, TX; Univ. of Texas (1975). 119p. University Microfilms Order No. 75-24,976.

Thesis (Ph. D.).

This is a study of multiparticle production in high energy pp collisions from the point of view of cluster models. The main result in this respect is the following. The presence of two non-trivial effects in the transverse momentum correlations of pions is established. Both effects are originated when the two pions emerge from different clusters: the azimuthal correlation as a function of energy depends essentially on the production dynamics. It therefore offers a crucial dynamical test when the rapidity gap separation between the two pions is large. If clusters have slow transverse motion (sharp transverse momentum cutoff), the pion correlation is significantly reduced from any initial correlation of

the parent clusters. To demonstrate the presence of these new effects, one takes the case of negative pions and explains the asymmetry parameter as a function only of energy, as a function of the average transverse momentum of the pions (when their rapidity gap is less than one). One further presents a prediction for a normalized azimuthal correlation at several energies due to the two cluster term. (Diss. Abstr. Int., B)

10555 SOME TOPICS CONCERNING N-N AND N-d EXPERIMENTS AT MEDIUM ENERGY. Simmons, J. E. (Los Alamos Scientific Lab., NM). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 103-127(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The status of recent proton-proton phase shift analyses is reviewed at medium energy with mention of the state of the n-p I equals 0 analyses. Some conclusions are reached, including a recommendation for renewed theoretical effort to calculate absorption parameters for N-N scattering above 300 MeV in higher partial waves (l greater than or equal to 3). Recent experimental data are examined for p-p small angle scattering at 630 and also near 500 MeV. Further small angle experiments on p-p and p-d scattering are deemed desirable. A brief discussion of recent n-p charge exchange experiments is given. Finally, the status of medium to high energy (100 to 2000 MeV) p-d elastic scattering is reviewed with emphasis on back angle scattering and the usefulness of p-d polarization measurements. (auth)

10556 HYPERNUCLEAR SYSTEMS AND HYPERON–NUCLEUS INTERACTION: THEORY. Gal, A. (Hebrew Univ. of Jerusalem). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 185-202(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Recent strangeness exchange reactions, initiated by K^- in flight on nuclei, are discussed within the framework of shell model classification for hypernuclear states. A unified description for low lying states, strongly excited continuum states and states hitherto unobserved is offered in the p-shell. It is argued that hypernuclear parameters such as the appropriate LAMBDA N exchange mixture and LAMBDA-nuclear spin-orbit strength are deducible from experimental data. Generalizations to heavier nuclei are discussed, and the relevance of corresponding experiments is stressed. Comments are made about K^- capture in ^{7}Li. (auth)

10557 MULTIPARTICLE PRODUCTION IN HIGH ENERGY HADRON-NUCLEUS COLLISIONS. Busza, W. (Massachusetts Inst. of Tech., Cambridge). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 211-237(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

A discussion is given of the use of nuclear targets for the study of the space-time evolution of multiparticle production, followed by a review of recent experimental results and their interpretation. (auth)

10558 d–Λ–d SYSTEM. Kolesnikov, N. N.; Chernov, S. M. (Moscow State Univ.). Yadern. Fiz.; 22: No. 1, 218-219(Jul 1975). (In Russian).

The possibility of the existence of a system consisting of two deuterons with parallel spin and a Λ particle was examined on the basis of presently available data. It was concluded that data on hypernuclei and elastic dd scattering do not contradict the possibility of the existence of bound d–Λ–d systems. They can be formed with sufficiently large probability by the passage of hypertritium through matter containing deuterium. (JSR)

Particle Invariance Principles and Symmetries

Refer also to abstract 10486.

10559 STATUS OF THE SEARCH FOR MUONLESS EVENTS IN THE BROAD BAND NEUTRINO BEAM AT NAL. Aubert, B.; Benvenuti, A.; Cline, D.; Ford, W. T.; Imlay, R.; Ling, T. Y.; Mann, A. K.; Messing, F.; Piccioni, R.; Pilcher, J.; Reeder, D. D.; Rubbia, C.; Stefanski, R.; Sulak, L. (Harvard Univ., Cambridge, MA). pp 125-138 of Proceedings of the Ninth Rencontre de Moriond. Vol. II. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P2.

The current status and results of the search for muonless events in the broad band neutrino beam at NAL are presented. An excess of events unaccompanied by muon is observed which cannot be explained by instrumental effects. The ratio of the unaccompanied events to the customary charged current events is 0.20 ± 0.05 for the mixture of ν and $\bar{\nu}$ in this beam. (auth)

General

10560 FERMI–BOSE SUPERSYMMETRY. Wess, J. (Karlsruhe Univ. (TH) (F. R. Germany)). pp 352-369 of Trends in Elementary Particle Theory. Rollnik, H.; Dietz, K. (eds.) (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Berlin; Springer (1975).

11 refs.

Supersymmetries combine particles with different spin — Bosons and Fermions — in one supermultiplet. Relativistic models exist which contain SU(6) as a symmetry in the restframe. This aspect of supersymmetry is considered in these lectures. Group theoretical methods are developed, invariant Lagrangians constructed and the content of quantum numbers in supermultiplets investigated. (GE)

Applications (Electromagnetic and Weak)

Refer also to abstracts 10476, 10478, 10479, and 10482.

10561 $\psi' \to \psi\pi\pi$ DECAY AS A TEST OF PARTIAL CONSERVATION OF AXIAL-VECTOR CURRENT. Morgan, D.; Pennington, M.R. (Rutherford Laboratory, Chilton, Didcot, Berkshire, OX11 OQX, England). Phys. Rev. D 12: No. 5, 1283-1288 (1 Sept 1975).

The shape of the $\pi^+\pi^-$ mass distribution in the recently analyzed $\psi' \to \psi\pi\pi$ decay is explained. Although the explanation assumes the known general features of the $\pi\pi$ s-wave amplitude, detailed alternatives are not distinguished; rather, it is the on-shell appearance of the Adler zero which is crucial. The extension of this description to other dipion production processes is illustrated with a discussion of low energy $\pi^- p \to \pi^+\pi^- n$. (auth)

10562 EXACT LEFT-RIGHT SYMMETRY AND SPONTANEOUS VIOLATION OF PARITY. Senjanovic, G.; Mohapatra, R.N. (Department of Physics, The City College of the City University of New York, New York, New York 10031). Phys. Rev. D 12: No. 5, 1502-1505 (1 Sept 1975).

Left-right-symmetric gauge models suggested previously to describe all interactions of elementary particles within a single unified framework are further shown to have the desirable property that maximal parity violation in low-energy weak processes arises purely as a result of spontaneous breakdown of the local gauge symmetry. We also discuss the question of dynamical origin of parity violation. (auth)

10563 NEW WEAK INTERACTION ADDED TO THE INTERACTION OF THE WEINBERG-SALAM TYPE IN THE STANDARD SU(4) FOUR-QUARK MODEL. Suzuki, M. (Department of Physics, University of California—Berkeley, Berkeley, California 94720). Phys. Rev. D 12: No. 5, 1307-1313 (1 Sept 1975).

A new weak interaction due to scalar-boson exchange is proposed in the standard SU(4) four-quark model of weak, electromagnetic, and strong interactions. This interaction, which is added to the conventional vector-exchange weak interaction, is assumed to dominate in nonleptonic decays. It transforms like a pentadecimet component of SU(4), thus leading to strict strangeness conservation for charm-changing processes and a pure octet spurion for strangeness-changing processes. All of the desirable features built into the original model, such as suppression of $\Delta S=2$ transitions, are preserved even after inclusion of the new interaction. (auth)

10564 PARITY NONCONSERVATION IN TWO-NUCLEON SYSTEMS. Nagle, D. E. (Los Alamos Scientific Lab., NM). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 497-503(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The observation of a violation of the parity symmetry in two-nucleon systems implies the presence of a weak hadronic force. The positive effect reported by Lobashov et al. in the reaction np yields d gamma, for the circular polarization of the gamma ray, would imply a large value for the parity nonconserving (PNC) amplitude. A transmission experiment was undertaken for 15-MeV longitudinally polarized protons on hydrogen. A transmission experiment for 6-GeV polarized protons on Be and on H_2O is in progress at the ZGS at Argonne National Laboratory. The current results of the latter two experiments are summarized, and the relation to theoretical calculations is discussed. (auth)

Applications (Strong)

Refer also to abstracts 10516 and 11016.

10565 REMARKS ON POSSIBLE MESON SYMMETRIES BASED ON OUTER PRODUCT GROUPS. Bose, S.K. (Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556). Phys. Rev. D 12: No. 5, 1508-1511 (1 Sept 1975).

A previously discussed model of meson symmetries based on the group SU(3) ⊗(3) is updated by (1) giving rigorous proof of a first-order mass formula obtained previously, (2) deriving a second-order mass formula, and (3) extending the whole treatment to SU(4) ⊗SU(4). Tentative assignments are made for the new mesons ψ (3100), ψ (3700), and ψ (4100) in this scheme. (auth)

10566 IMPLICATIONS OF BROKEN SU(4) ⊗ SU(4) AND SCALE SYMMETRY FOR THE MASSES OF CHARMED PARTICLES. Genz, H. (Institut für Theoretische Kernphysik der Universität, Karlsruhe, Karlsruhe, Germany); Katz, J. Phys. Rev. D 12: No. 5, 1429-1432 (1 Sept 1975).

Making use of chiral SU(4) ⊗ SU(4) and scale-symmetry breaking together with ϵ saturation we obtain limits for the charmed-pseudoscalar-meson masses. These limits only allow charmed ($C=\pm1$) pseudoscalar states with masses below 2.5 GeV. The existence of such states with masses above 1.5 GeV would imply strong restrictions on the theory: δ has at least dimension $l_\delta=1$, u has at least dimension $l_u=2$, and the ϵ mass is higher than the upper limit noted in the Particle Data Group table. If the masses of these states are above 2 GeV, it furthermore follows that $l_u = 3$ and $l_\delta = 2$. Assuming the Gaillard-Lee-Rosner relation between the masses of the vector mesons and the quarks, identification of the ψ (3.1) with the ϕ_c implies $l_u=3$, $l_\delta=2$, $m_\epsilon\simeq0.92$ GeV, $\Gamma_\epsilon\simeq0.42$ GeV, and $m_D=2.2$ GeV. We have assumed integer dimensions. We have furthermore assumed that the effective m_ϵ is not much above 0.9 GeV. (auth)

10567 NEW MESONS AND BROKEN SU(3) ' × SU(3) " (color). Marinescu, N.; Stech, B. (Institut für Theoretische Physik, der Universität Heidelberg, Heidelberg, Germany). Phys. Rev. D 12: No. 5, 1356-1364 (1 Sept 1975).

An attempt is made to classify the newly discovered heavy mesons into broken SU(3) '×SU(3) " (color) multiplets. Mass formulas and decay properties are discussed in connection with a suggestive scheme of symmetry breaking. The model leads to numerous predictions which will soon allow it to be substantiated or rejected on the basis of experiment. One of them is the existence of a broad resonance at ≃4.8 GeV in the photon channel. From presently known experimental data or theoretical considerations no stringent objections arise; on the contrary, several facts do favor this approach. (auth)

10568 $SU_4 \times SU_3^c$ ASSIGNMENT FOR Ψ-PARTICLES AND THE TWO-SELECTION-RULE MECHANISMS FOR THEIR DECAYS. Aydin, Z. Z. (Univ. of Ankara). Lett. Nuovo Cim.; 14: No. 12, 448-452(22 Nov 1975).

A different assignment is attempted for the ψ particles with respect to the group SU(4) × SU(3C), which explains besides the other predictions why the dominant decay mode of the Ψ(3.7) is Ψ^1(3.1) + anything and why the decays of the Ψ^1 into an odd number of pions are much less than the corresponding decays of the Ψ. The motivation for choosing this group and the assignment come mainly from the behavior of the ratio $R = \sigma(e^+e^- \to \text{hadrons})/\sigma(e^+e^- \to \mu^+\mu^-)$ which has the asymptotic expression $R = \Sigma Q_i^2$ in the parton model. (JFP)

10569 PARITY AND TIME-REVERSAL SYMMETRIES IN NUCLEAR SYSTEMS. Boehm, F. (California Inst. of Tech., Pasadena). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 488-496(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

In this lecture experimental evidence pertaining to the parity and time-reversal symmetries in nuclei and few-nucleon systems, as well as their theoretical implications are reviewed. My presentation will be restricted to hadronic systems only, leaving out such processes as nuclear beta decay or muon decay. (auth)

Scattering Theory

Refer also to abstract 11066.

10570 (CNRS-CPT-75-P-720) TRACING BACK RESONANCES TO FAMILIES OF REGGE TRAJECTORIES. New Finite Energy Sum Rules. Mandelbrojt, J. (Centre National de la Recherche Scientifique, 13 – Marseille (France). Centre de Physique Theorique). Apr 1975. 18p. INIS.

An amplitude is supposed to be expressed for large enough energies as a sum of contributions of Regge poles. Calling family of trajectories the set of trajectories which differ by integers from one of them, a correspondance, such that the energy and width of a given resonance depend on only family of trajectories, is established between resonances of the amplitude and families of trajectories. The contribution to the amplitude of each family of trajectories is shown to satisfy the same finite energy sum rules as does the amplitude itself. In these sum rules the resonance approximation can be made where the only resonances that will appear are those which are in correspondence with the family. (FR)

10571 (CONF-720133–P6, pp 1-17) CONFIGURATION SPACE DESCRIPTION OF THE REGGE LIMIT AND ASYMPTOTIC BEHAVIOR IN LIGHTLIKE DIRECTIONS. Woo, C. H.; Robilotta, M. R.; Silva, A. J. (Univ., Sao Paulo, Brazil). 1972.

From 4th symposium on theoretical physics; Rio de Janeiro, Brazil (4 Jan 1972).

In IV Brazilian symposium on theoretical physics. Vol. VI.

The treatment of configuration space description of the Regge limit and asymptotic behavior in lightlike directions includes the light cone and Regge limit, configuration space analog of the Bjorken limit: $x \cdot p \to \infty$ with xp/x^2 fixed, the nonforward case, comparison with other fields, and the physical interpretation of the lightlike asymptotic behavior. (JFP)

10572 (DL/R-36) REGGE PHENOMENA. Daresbury Lecture Note Series No. 14. Notes on a Series of Lectures Given at Daresbury Laboratory, 7–11 April 1975. Michael, C. (Science Research Council, Daresbury (UK). Daresbury Lab.). 1975. 31p. Dep. NTIS (US Sales Only) $5.00.

Many features of data on high energy scattering can be best understood from a complex angular momentum or Regge approach. The Regge pole approach as such has had a history of alternating periods of excessive popularity and of rejection. It is thus worthwhile to review the field as it stands at present and to highlight the simple insights given by a Regge pole approach and also to bring out some of the complications such as those which lead to Regge cuts. As well as its tried and tested value in discussing two-body and quasi-two body scattering, Regge pole language has much to give to multiparticle scattering and this is sketched in the last section. (auth)

10573 (JINR–E2-9128) POTENTIAL LARGE-ANGLE SCATTERING IN PHASE FUNCTION METHOD. Khankhasaev, M. Kh. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 25p. Dep. NTIS (US Sales Only) $4.50.

The high energy potential scattering theory is constructed on the basis of a new approach which is a natural generalization of the phase function method. The extension of the eikonal approximation to large angles is obtained. Some numerical calculations are carried out to compare the approximation for the scattering amplitude with well known ones. Its nonlinearity in potential corrections is consistently evaluated. (auth)

10574 (JINR–P4-9213) INTEGRAL EQUATION FOR THE WAVE FUNCTION OF THREE IDENTICAL PARTICLES IN THE BOUNDARY CONDITION MODEL. III. The Model with the Energy Dependent Logarithmic Derivative. Efimov, V. N. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 18p. (In Russian). Dep. NTIS (US Sales Only) $3.50.

The boundary condition model with the linearly energy dependent logarithmic derivative was considered for two particles. It is shown that at the wave function orthogonality concerned such a model is equivalent to the introduction of a potential dependent on the energy in a linear way. The limiting form of the potential corresponds to the boundary condition model with the constant logarithmic derivative. The binding energy of three identical bosons was calculated on the basis of the Faddeev equations, and the limit value of this energy was determined. (auth)

10575 COVARIANT PARTON MODEL. Pokinghorne, J. C. (Cambridge Univ. (UK)). pp 210-233 of Trends in Elementary Particle Theory. Rollnik, H.; Dietz, K. (eds.) (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Berlin; Springer (1975). 18 figs.; 21 refs.

Deep inelastic scattering, inclusive differential cross-sections for hadrons in the quark fusion model and hadronic Bjorken limit of parton amplitudes, different scattering models, the leading particle model, exclusive processes and the dimensional counting ansatz are discussed in the parton model. (GE)

10576 CONVERGENT FIXED-MASS SUM RULES FROM CURRENT ALGEBRA. Taha, M. O. (International Centre for Theroretical Physics, Trieste, Italy). Nuovo Cim., A; 30A: No. 1, 144-154(1 Nov 1975).

The refined infinite-momentum limit is improved by introducing Regge subtractions to remove divergences in the fixed-mass limit, taking scaling behavior into account. (auth)

10577 HIGH ENERGY SCATTERINGS AND THE JOST–LEHMANN–DYSON REPRESENTATIONS. Phat, T. H. (Inst. of Theoretical Physics, Warsaw). Nuovo Cim., A; 30A: No. 1, 47-62(1 Nov 1975).

On the basis of the renormalization group equation, it is proved that the quasi-limit for the weight function of the Jost-Lehmann-Dyson representative actually exists. In this connection, the high energy behaviors of scattering amplitudes of hadron–hadron elastic processes are considered in various asymptotic regions. The main results are: the Regge behavior is possible in some cases and impossible in others; whenever the Regge behavior occurs, the large-t behavior of differential cross sections is of scaling form. In addition, the large-t values of the Regge-trajectory function and cut are defined by the characteristics of the renormalization group; in comparison with the interchange parton models, it is deduced that anomalous dimension of field operator $\gamma(g_\infty)$ is related to the minimum number of partons contained in the corresponding particle by the following step $\gamma(g_\infty) = n-1$. (auth)

10578 RECONSTRUCTION OF COUPLED TWO-BODY CHANNEL AMPLITUDES. Benayoun, M. (College de France, Paris); Cornille, H. Nuovo Cim., A; 30A: No. 1, 1-33(1 Nov 1975).

The problem of reconstructing, at a fixed energy, the amplitude of an inelastic reaction AB → CD from its differential cross section is examined. It is furthermore assumed that the inelasticity proceeds from the coupling to two-body channels and that one knows entirely one of the two elastic amplitudes AB → AB, CD → CD, but not both. It was first proven that, in the case of an infinite number of partial waves, the trivial ambiguities of the reconstructed amplitudes are reduced to a possible complex conjugation eventually combined with a change of sign. Secondly one studies the particular case of inelastic amplitudes described with a finite number of partial waves. For $L_{max} \leq 5$ it is shown that no more than three nontrivially related solutions can exist simultaneously. (auth)

10579 SUGGESTIVE FACTORIZATION SCHEME OF THE DUAL RESONANCE MODEL WITH ANTICOMMUTING OPERATORS. Lee, Y. Y. (National Tsing Hua Univ., Hsinchu, Taiwan). Chin. J. Phys. (Taiwan); 13: No. 1, 72-83(Apr 1975).

A method to factorize the Veneziano amplitude by means of anticommuting operators is suggested. This factorization scheme is shown to work at least for the four point and the five point amplitudes. The success of this factorization scheme will enable one to construct DRM amplitudes involving fermions. (auth)

10580 UNIQUE INELASTIC PHASE SHIFTS FROM GENERAL STRUCTURE IN TWO VARIABLES. Burkhardt, H.; Martin, A. (CERN, Geneva). Nuovo Cim., A; 29A: No. 2, 141-152(21 Sep 1975).

One looks for valid general properties of the spinless scattering amplitude, which are sufficient to determine it uniquely from a complete set of perfect data, making the minimum use of elastic unitarity. In addition to analytic properties in both kinematic variables, the positivity of the imaginary parts in the real positive momentum transfer strips is essential. Even then a small amount of extra information is still needed. The difficulty of using these results in a practical analysis is discussed. They do throw light on other attempts to use analytic properties to remove phase-shift ambiguities, and suggest that fixed-t dispersion relations may provide a sound basis. (auth)

10581 ASPECTS OF FREQUENCY REDISTRIBUTION FOR NON-COHERENT SCATTERING IN A TURBULENT MEDIUM. Magnan, C. (CNRS, Paris). J. Quant. Spectrosc. Radiat. Transfer; 15: No. 10, 979-989(Oct 1975).

The scattering of line photons in a turbulent medium is reexamined. The fact is taken into account that a photon absorbed in a turbulent element having some velocity will be reemitted by the same element and keeps in that way a certain "memory" of its absorption. Adding the contributions of all turbulent elements at a given point new redistribution functions are constructed, describing this correlation. They give the probability that a photon with frequency x in the direction n is absorbed and reemitted at frequency x′ in the direction n′. A preliminary discussion of the problem is given in an astrophysical context. (auth)

10582 RESCATTERING CORRECTIONS AND THE POMERON STRUCTURE. Ciafaloni, M. (CERN, Geneva); Marchesini, G. pp 339-351 of Proceedings of the Ninth Rencontre de Moriond. Vol. I. Tran Thanh Van, J. (ed.). Orsay, France; Universite de Paris (1974).

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974). See CONF-740332-P1.

An approximate treatment is given of long-range absorption due to elastic rescattering of pairs of particles in the final state. By this method one estimates absorptive corrections to Pomeron vertex and propagator, and discusses the strong coupling scheme of the Gribov calculus. (auth)

10583 METHOD TO GENERATE SOLVABLE NONLINEAR EVOLUTION EQUATIONS. Calogero, F. (Univ., Rome). Lett. Nuovo Cim.; 14: No. 12, 443-447(22 Nov. 1975).

A class of nonlinear evolution equations that are solvable by the inverse-scattering method is derived. They obtain from appropriate use in the context of the one-dimensional Schroedinger equation, of a generalized Wronskian relation. The main interest of the method relates to the novelty and simplicity of the approach and to its delivery of nonlinear evolution equations that may involve more than one (space) variable and contain coefficient that are not constant. (JFP)

10584 CHARACTERISTICS OF INELASTIC PROCESSES AND THE ENERGY CONSERVATION LAW IN THE EIKONAL APPROXIMATION. Andreev, I. V. (Lebedev Inst. of Physics, Moscow). Yadern. Fiz.; 22: No. 1, 186-197(Jul 1975). (In Russian).

The formulas for various characteristics of inelastic processes are given in the eikonal approximation. The effect of the eikonal iterations on those characteristics is briefly discussed. The model, in which a weak growth of the cross section is allowed, is used to estimate the corrections to the eikonal formulas arising due to restrictions imposed by the energy conservation law. (auth)

PHYSICS (LOW-TEMPERATURE)

Superconductivity

Refer also to abstracts 9832–9834, 9855, 9856, 9865, 9867, 9871, 9912, 9941–9943, and 11414.

10585 (AD–782839) COMMENT ON MODEL FOR AN EXCITON MECHANISM OF SUPERCONDUCTIVITY. Inkson, J. C.; Anderson, P. W. (Cambridge Univ. (UK). Cavendish Lab.). 2 Mar 1973. 6p. NTIS.

The excitonic mechanism of superconductivity in a metal-semiconductor system is studied from the point of view of the complete electron-electron interaction. It is shown that recent calculations of an enhancement of the superconducting transition temperature by way of virtual excitons involves a double counting of these processes. Once this is taken into account the enhancement disappears. The local-field effects in the semiconductor are discussed but it is shown that the off-diagonal elements of the interaction are no help in recovering the enhanced superconductivity. (auth)

10586 DENSITY OF STATES IN TYPE-II SUPERCONDUCTORS IN HIGH MAGNETIC FIELDS. Pesch, W. (Technische Univ. Hannover (F. R. Germany). Inst. fuer Theoretische Physik). Z. Phys., B; 21: No. 3, 263-267(1975).

4 figs.; 16 refs.

Using the Gorkov theory as modified by Eilenberger a consistent calculation scheme was derived for the density of states near the upper critical field. This method applies to arbitrary impurity concentration and becomes particularly simple in the clean limit. Special attention was paid to the effect of anisotropic impurity scattering (p-waves). (auth)

10587 PAIR BREAKING AND DENSITY OF STATES IN DISORDERED SUPERCONDUCTORS. Weinkauf, A.; Zittartz, J. (Koeln Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Z. Phys., B; 21: No. 2, 135-140(Jun 1975).

3 figs.; 11 refs.

It is shown that pair breaking occurs in a disordered superconductor due to spatial variations of the order parameter, although the system is time reversal invariant. The pair breaking effect is reflected by the occurrence of some interesting fine structure in the one particle density of states. Discrete bound states and split-off impurity bands show up in the single impurity case and for very dilute alloys, respectively. For finite alloy concentrations the calculations are done within the CPA. Although principally important, the fine structure is concentrated in an energy range too narrow to be detected experimentally. (auth)

10588 HIGH-TEMPERATURE ELECTRICAL RESISTIVITY AND SUPERCONDUCTIVITY OF CESIUM AT HIGH PRESSURES. Gandel'man, G.M.; Itskovich, O.Yu.; Finkel'berg, V.M. Sov. Phys.–Solid State 17: No. 4, 786-787 (Apr 1975).

Calculations are presented on the electric conductivity and superconductivity parameters of cesium as a function of pressure. A spherical Debye spectrum is used for the phonon spectrum. (AIP)

10589 RIGOROUS STUDY OF THE GAP EQUATION FOR AN INHOMOGENEOUS SUPERCONDUCTING STATE NEAR T_c. Hu, C. (Department of Physics, University of Southern California, Los Angeles, California 90007). Phys. Rev. B 12: No. 9, 3635-3649 (1 Nov 1975).

A rigorous analytic study of the self-consistent gap equation (symbolically $\Delta = F_T[\Delta]$), for an inhomogeneous superconducting state, is presented in the Bogoliubov formulation. The gap function $\Delta(\vec{r})$ is taken to simulate a planar normal-superconducting phase boundary: $\Delta(\vec{r}) = \Delta_\infty \tanh(\alpha\Delta_\infty z/v_F)\,\Theta(z)$, where $\Delta_\infty(T)$ is the equilibrium gap, v_F is the Fermi velocity, and $\Theta(z)$ is a unit step function. First a special space integral of the gap equation $\propto_{I+}{}^{\infty}(\mathcal{J}_T-\Delta)(d\Delta/dz)\,dz$ is evaluated essentially exactly, except for a nonperturbative WKBJ approximation used in solving the Bogoliubov-de Gennes equations. It is then expanded near the transition temperature T_c in power of $\Delta_\infty \propto (1-T/T_c)^{1/2}$, demonstrating an exact cancellation of a subseries of "anomalous-order" terms. The leading surviving term is found to agree in order, but not in magnitude, with the Ginzburg-Landau-Gor'kov (GLG) approximation. The discrepancy is found to be linked to the slope discontinuity in our chosen Δ. A contour-integral technique in a complex-energy plane is then devised to evaluate the local value of $\mathcal{J}_T-\Delta$ exactly. Our result reveals that near T_c this method can reproduce the GLG result essentially everywhere, except within a BCS coherence length [not $\xi(T)$!] from a singularity in Δ, where $\mathcal{J}_T-\Delta$ can have a singular contribution with an "anomalous" local magnitude, not expected from the GLG approach. This anomalous term precisely accounts for the discrepancy found in the special integral of the gap equation as mentioned above, and likely explains the ultimate origin of the anomalous terms found in the free energy of an isolated vortex line by Cleary. (auth)

10590 SUPERCONDUCTING TRANSITION TEMPERATURE AND OTHER PROPERTIES OF THIN METALLIC FILMS. Allen, R.E. (Department of Physics, Texas A&M University, College Station, Texas 77843). Phys. Rev. B 12: No. 9, 3650-3651 (1 Nov 1975).

We point out that the results of (1) Shapoval, for the superconducting transition temperature of a thin film, (2) Nedorezov, for the surface contributions to the density of states, Fermi energy, and specific heat, and (3) Cooper and Hu, for the surface contribution to the density of states, are entirely unphysical because they are obtained from inconsistent models which violate the surface analog of the Friedel sum rule, $\langle\gamma\rangle = \pi/4$. (auth)

10591 MODIFIED HEATING THEORY OF NONEQUILIBRIUM SUPERCONDUCTORS. Parker, W.H. (Department of Physics, University of California, Irvine, Irvine, California 92664). Phys. Rev. B 12: No. 9, 3667-3672 (1 Nov 1975).

Most recent experiments on nonequilibrium superconductors have been interpreted in terms of a theoretical model that assumes the recombination time of quasiparticles acts as a bottleneck in the quasiparticle relaxation process. However, in all experiments to date, the actual bottleneck is the escape time of recombination phonons from the superconductor. We show that all previous experiments can be interpreted in terms of a modified heating theory where the quasiparticles remain in both thermal and chemical equilibrium at an effective temperature T^* greater than the helium-bath temperature. The temperature T^* is determined from a consideration of only those phonons with energy greater than 2Δ. (auth)

10592 STUDIES OF PARALLEL AND TILTED VORTICES IN TYPE-II SUPERCONDUCTORS BY MICROWAVE ABSORPTION. Monceau, P. (Centre National de la Recherche Scientifique–Centre Recherche sur les Très Basses Températures B.P. 166, F 38042 Grenoble, France); Saint-James, D.; Waysand, G. Phys. Rev. B 12: No. 9, 3673-3689 (1 Nov 1975).

A general study is made of the observation of size effects in type-II superconducting films by microwave absorption. A new class of size effects is presented that we attribute to the interference of tilted vortices (generated by a tilted magnetic field on the sample) with the surface sheath. A putative geometrical model is presented, which is in good agreement with experimental data. An extension of this model is made to multilayered superconductive compounds (dichalcogenides). (auth)

10593 THERMODYNAMIC PROPERTIES OF SUPERCONDUCTING β-Ga AND α-Ga. Gubser, D.U. (Naval Research Laboratory, Washington, D. C. 20375); Parr, H. Phys. Rev. B 12: No. 9, 3968-3970 (1 Nov 1975).

From recent measurements of the critical-magnetic-field curve in β-Ga, we calculate the energy-gap parameter $\delta = 1.016 \pm 0.026$ and the anisotropy parameter $\langle a^2\rangle = 0.012 \pm 0.019$, and we present a new determination of the zero-temperature critical magnetic field of α-Ga, which yields $H_0 = 58.3 \pm 0.1$ Oe. The thermodynamic properties of superconducting β-Ga and α-Ga are compared and discussed. Possible evidence for soft phonon modes in β-Ga is suggested. (auth)

10594 ELASTIC MODULUS, THERMAL EXPANSION, AND SPECIFIC HEAT AT A PHASE TRANSITION. Testardi, L.R. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. B 12: No. 9, 3849-3854 (1 Nov 1975).

The interrelation of the elastic modulus, thermal-expansion coefficient, and specific heat of a transformed phase relative to the untransformed phase is calculated assuming a particular but useful form of the thermodynamic potential. For second-order phase transitions where this potential applies, measurements of modulus, expansion, and specific heat can yield the general (longitudinal as well as shear) first- and second-order stress (or strain) dependences of the transition temperature and of the order parameter at absolute zero. An exemplary application to one type of phase transition is given. (auth)

10595 SOME RIGOROUS RESULTS ABOUT GINZBURG–LANDAU EQUATIONS. Micheletti, A. (Univ., Pisa, Italy); Pace, S.; Zirilli, F. Nuovo Cim., 29B: No. 1, 87-99(11 Sep 1975).

The Ginzburg–Landau equations are studied using the techniques of nonlinear functional analysis. In the absence of a magnetic field, for a generic geometry, the existence of a nontrivial branch of solutions is shown, the direct method of the calculus of variations and the Liusternik–Schrmirelmann category theory are used to study the free-energy functional. In the presence of magnetic field, for a cylindric geometry, the existence of a nontrivial branch of solutions is shown and the direct method of calculus of variations is used to study the free-energy functional. (auth)

PHYSICS (NUCLEAR)

10596 (COO-535-733) TECHNICAL PROGRESS REPORT AND PROPOSAL FOR CONTINUATION OF CONTRACT. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics). 1 Nov 1975. Contract E(11-1)-535. 141p. Dep. NTIS $7.00.

A considerable amount of experimental work was done on the importance of two-step mechanisms in nuclear reactions. The medium-energy experimental group participated in construction of the EPICS facility at LAMPF. The theoretical program concentrated on investigations of pi-nucleus interactions and finite-range effects. The report is arranged as follows: experimental program (nuclear physics, intermediate energy physics, apparatus and facility development, cyclotron operation, outside users of cyclotron facilities), theoretical program, publications and reports, and personnel. The nuclear physics section of the report contains work on charged-particle experiments (single-nucleon-transfer reactions, multinucleon-transfer reactions, charge-exchange reactions, elastic and inelastic scattering, charged-particle reaction studies on ^{14}C), gamma-ray experiments and beta decay, neutron time-of-flight experiments, x-ray fluorescence trace element analysis, and other activities. Seventeen items with significant amounts of data are listed separately by title. (RWR)

For titles of individual papers see: 10357, 10640–10643, 10722–10724, 10752–10756, 10785, 10786, 10849, and 10883.

10597 (COO-1265-170) JOHN H. WILLIAMS LABORATORY OF NUCLEAR PHYSICS, UNIVERSITY OF MINNESOTA, ANNUAL REPORT, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics). Sep 1975. Contract E(11-1)-1265. 288p. Dep. NTIS $10.25.

Of the 46 items in this report, 35 are concerned with results of the research program (scattering and reactions of light nuclei, inelastic monopole transitions and microscopic analysis of inelastic scattering, reactions and levels in medium to heavy nuclei, work with heavy ions, hyperfine and x-ray experiments); 3, with experimental equipment and techniques; 4, with accelerator auxiliaries, development, and operation; 1, with the work of the LAMPF users' group; and 3, with personnel, degrees, and reports and publications. Twenty-eight research reports containing significant amounts of information are listed separately by title. (RWR)

For titles of individual papers see: 10293, 10294, 10614–10619, 10690–10694, 10725–10729, 10787–10789, 10850–10852, 10884, 10885, 10956, and 10957.

10598 (JUL-CONF-16(VOL.1)) INTERNATIONAL SYMPOSIUM ON HIGHLY EXCITED STATES IN NUCLEI, JUELICH, 23–26 SEPTEMBER 1975. Volume 1. Contributed Papers. Faessler, A.; Mayer-Boericke, C.; Turek, P. (eds.). (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik). Jul 1975. 136p. (CONF-750976-P1). Dep. NTIS (US Sales Only) $7.00.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

115 contributed papers are announced in Nuclear Science Abstracts, 8 of which appear also in ERDA Research Abstracts. (SDF)

For titles of individual papers see: 10624, 10625, 10649–10667, 10699–10711, 10739–10743, 10764–10770, 10799–10818, 10854–10871, 10889–10900, 10942, 10943, and 10970–10986.

Neutron Interactions with Matter

Refer also to abstracts 9382, 10955, and 11065.

10599 (AAEC/E-336) COMPARISON OF CALCULATIONS MADE WITH THREE TIME-DEPENDENT NEUTRON CODES TDA, MORSE, AND POW. McGregor, B.; Harrington, B. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Dec 1974. 22p. Dep. NTIS (US Sales Only) $4.50.

Three computer codes were compared to determine their usefulness in analyzing a pulsed neutron experiment. The codes were a Monte Carlo code (MORSE) a diffusion kinetics code (POW) and a time dependent SN code (TDA). A series of test problems were devised to progressively model the experiment. All problems assumed a spherical system with an isotropic source. The first problem had its source in the first energy group for the first nanosecond. The second problem had its source distributed in time but not distributed in energy. The third problem had a source distributed in energy and time. POW and MORSE were shown to be in good agreement, with significant differences occurring only at times when the system did not correspond with the approximations made in POW. The AAEC version of the TDA code did not handle a time-dependent source. There was also a tendency for the results beyond 50 ns to be higher than those for the other two codes for the problems having a source constant over one time interval. (7 figures, 4 tables) (auth)

10600 (CONF-751006-15) THEORY OF RADIATION INDUCED DEFECT PRODUCTION. Robinson, M. T. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. 21p. Dep. NTIS $4.50.

From international conference on radiation damage in metals; Gatlinburg, Tennessee, USA (5 Oct 1975).

The theory of defect production in solids by neutron irradiation is reviewed, including discussions of the nuclear reactions which produce the primary recoils and the loss of energy from the displacement cascade by electron excitations. The theoretical predictions are compared with the limited available experiments on thermal and fast neutron irradiation. The results are in rough agreement in most instances, but further improvements in the theory are clearly needed. (auth)

10601 (INIS-mf-1698, pp 230-236) DEPENDENCE OF THE PARAMETRIZATION ACCURACY OF NEUTRON CROSS SECTIONS ON CROSS-SECTION MEASUREMENT METHODS. Muradyan, G. V. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A comparative analysis is presented of the precision of determining the parameters of neutron cross-sections as a function of the method of measurement used. It is shown that a combination of the time-of-flight method with the pseudo-random method gives the highest precision for the parameterization. (tr-auth)

10602 (INIS-mf-1698, pp 243-256) PRODUCTION, STORAGE, AND POLARIZATION OF ULTRACOLD NEUTRONS. Lobashev, V. M.; Porsev, G. D.; Serebrov, A. P. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Experimental results are presented on the yield of ultracold neutrons in neutron guides of different types. The results of storage of ultracold neutrons in nickel and glass traps and in traps with heating are considered. Data are presented on the polarization of ultracold neutrons obtained by thin transmission through thin ferromagnetic films. (tr-auth)

10603 (INIS-mf-1698, pp 286-292) LOGARITHMIC NEUTRON GUIDE FOR THE THERMAL NEUTRONS. Korotkikh, E. M.; Kondurov, I. A. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A logarithmic neutron guide for thermal neutrons, formed by a combination of two symmetrical sections of a logarithmic spiral, is described. The advantage of such a neutron guide is the high neutron flux at the outlet and the possibility of screening of fast neutrons. Two variants of the logarithmic neutron guide were calculated by a Monte Carlo method. (tr-auth)

10604 (LA-6105-MS) ANALYTIC TRANSPORT THEORY SOLUTIONS FOR STEADY SOURCES IN PURE ABSORBERS. Lee, C. E. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1975. Contract W-7405-ENG-36. 12p. Dep. NTIS $4.00.

The monoenergetic steady-state integral neutron transport equation is solved analytically for several simple source configurations for pure absorbers. Specifically, the scalar neutron flux, phi(r), is derived for configurations in cartesian geometry representing the point, infinite line, infinite plane, finite line, infinite ribbon, finite ribbon, infinite tube, and finite box sources. Some of these configurations (point, infinite line, and infinite ribbon sources) were investigated previously by Case, deHoffmann and Placzek and are reviewed here for completeness. The others are more complex and represent new analytic solutions against which multidimensional numerical transport calculational codes may be tested. (auth)

10605 SOLUTION OF THE REFLECTION AND TRANSMISSION PROBLEM IN NEUTRON TRANSPORT THEORY FOR PLANE

GEOMETRY BY THE METHOD OF DOUBLE GEGENBAUER POLYNOMIALS. De Corte, L.; Mertens, R. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). Atomkernenergie; 25: No. 3, 219-226(1975).

3 figs.; 2 tabs.; 8 refs.

Multiple scattering of neutrons with an isotropic single scattering law is treated for an absorbing half-infinite space or plane slab with an incident current of neutrons. The monoenergetic Boltzmann equation is solved by using a double Gegenbauer polynomial expansion so that the boundary conditions are exactly fulfilled. The reflection and transmission coefficients are calculated. In first approximation, double Legendre polynomials are preferred to other polynomial systems which are useful only in isolated cases. (auth)

10606 COMPARISON OF TWO VARIATIONAL FUNCTIONALS IN THE CALCULATION OF THE EXTRAPOLATION DISTANCE FOR A BLACK CYLINDER. Williams, M. M. R. (Queen Mary Coll., London (UK). Dept. of Nuclear Engineering). Atomkernenergie; 25: No. 3, 214-218(1975).

1 tab.; 10 refs.

We formulate a pair of coupled integral equations for the neutron flux in an infinite cylinder of arbitrary cross-sectional shape. Linearly anisotropic scattering in the medium is assumed. These equations are reduced to a tractable form for a circular cross-section whose properties depend only on the radius vector. Considering the case of isotropic scattering, we compare the accuracy of two variational functionals for calculating the extrapolation distance of a black cylinder. These are the Marshak functional and the Kushneriuk and McKay functional. We find, in contrast to the results obtained by Sahni and Marshak for black spheres, that Marshak's functional is the least accurate and we therefore conclude that the efficiency of a particular functional will depend to some extent on the geometry of the problem. (auth)

10607 COLD NEUTRON SCATTERING FROM WATER VAPOR MOLECULES. Sefidvash, F. (Arya-Mehr Univ. of Technology, Teheran (Iran)). Atomkernenergie; 25: No. 4, 285-287(1975).

4 figs.; 6 refs.

In order to study the effect of potential interaction between molecules, cold neutrons were scattered from saturated and superheated water vapors both at a constant temperature of 455 K. The neutron spectra were taken with the time-of-flight method at scattering angles of 15, 40, 65, and 120 degrees for comparison. (auth)

10608 INVESTIGATIONS ON THE RESONANCE INTEGRAL OF HAFNIUM. Jonas, H.; Hecker, R. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung); Giesser, W. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (F. R. Germany)). Atomkernenergie; 25: No. 4, 271-275(1975). (In German).

4 figs.; 7 tabs.; 13 refs.

Recent measurements of the resonance integral of $Hf_{(nat)}$ performed with the aid of a lead spectrometer have been analyzed and compared with calculations based on published resonance parameters. Remarkable differences are shown to exist between the experiment and the calculations. As the result of our analysis a modified set of resonance parameters for hafnium is presented, which results in a good agreement between the calculated and the measured values of the resonance integral. (auth)

10609 FLUX DEPRESSION AND THE ABSOLUTE MEASUREMENT OF THE THERMAL NEUTRON FLUX DENSITY. Bensch, F. (Atominstitut der Oesterreichischen Hochschulen, Vienna). Atomkernenergie; 25: No. 4, 257-264(1975).

7 figs.; 3 tabs.; 51 refs.

The thermal neutron flux depression in a diffusing medium by an absorbing foil has been treated in numerous papers. The results are re-examined in an attempt to find a uniform and physically meaningful representation of the "activation correction." This quantity can be split up into a combination of probabilities. Thus, it is possible to determine the activation correction for any moderator and foil material. Measurements confirm the utility of the concepts introduced. (auth)

10610 EVALUATION OF TEMPERATURE DEPENDENT NEUTRON RESONANCE INTEGRALS. Menon, S. V. G.; Sahni, D. C. (Bhabha Atomic Research Centre, Bombay (India). Theoretical Physics Section). Atomkernenergie; 25: No. 4, 265-270 (1975).

3 tabs.; 11 refs.

The Fourier transform method is extended for evaluating temperature dependent resonance integrals and Doppler coefficients. With the temperature dependent cross-sections, the slowing-down equation is transformed into a Fredholm integral equation of second kind. A method of solution is presented using the familiar Gauss-Hermite quadrature formulae. As a by-product of the above technique, a fast and accurate method for computing the resonance integral J-function is given. (auth)

10611 SYMMETRIC NEUTRON FLUXES FOR THE INVESTIGATION OF THE FLUX SHAPE VALUE. Bulla, W. (Technische Hochschule, Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik). Atomkernenergie; 26: No. 1, 12-20(1975). (In German)

2 figs.; 6 refs.

The present investigation continues the work of a previous one, in which a material parameter, the flux shape value, has been introduced within the framework of transport theory. Now these concepts are completed by giving expressions for spherically and cylindrically symmetrical directed fluxes, which are particularly important in applications. The behavior of these solutions depending on space and direction coordinates is investigated together with that of the undirected flux, which is obtained from the former solutions by integration over the direction variables. Finally the restrictions are indicated to which those solutions must be subjected since they describe the fluxes within a multiplying zone. (auth)

10612 STUDY OF HYDROGEN ADSORBED ON PLATINUM BY NEUTRON INELASTIC SCATTERING SPECTROSCOPY. Asada, H.; Toya, T. (Research Institute for Catalysis, Hokkaido University, Sapporo, Japan); Motohashi, H.; Sakamoto, M.; Hamaguchi, Y. J. Chem. Phys. 63: No. 9, 4078-4079 (1 Nov 1975).

The inelastic neutron scattering spectra of hydrogen adsorbed on platinum is reported and analyzed. (AIP)

10613 THE WORK OF THE "IRRADIATION DAMAGE" SUBGROUP OF THE EURATOM WORKING GROUP ON RESEARCH REACTOR DOSIMETRY. Genthon, J. P. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France)). Nucl. Eng. Des.; 33: No. 1, 7-9(Aug 1975). (In French).

The EURATOM Working Group on Reactor Dosimetry is investigating the problems of the dosimetry of radiation damage experiments. Papers have been published on the dosimetry of graphite and irradiation of metals: the model chosen, the quantities employed to express the fluences, numerical values, measurements, and measurement techniques. The ensuing work of the EURATOM Working Group of Reactor Dosimetry in these areas will deal with the measurement methods required for the dosimetry of radiation damage. (NL)

Nuclear Properties and Reactions, $A \leq 5$

Refer also to abstracts 10532, 10537, 10639, 10956, and 11004.

10614 (COO-1265-170, pp 1-7) MEASUREMENT OF p+p ANGULAR DISTRIBUTIONS FROM 6 TO 14 MeV(LAB). Hegland, P. M.; Koepke, J. A.; Lilley, J. S.; Brown, R. E. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10615 (COO-1265-170, pp 8-10) RESONATING-GROUP CALCULATIONS WITH COULOMB EXCHANGE FOR d+d SCATTERING. Hegland, P. M.; Brown, R. E. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10616 (COO-1265-170, pp 11-27) TOTAL REACTION CROSS SECTIONS FOR p + ^{3} ^{4}He FROM 18 TO 48 MeV. Sourkes, A. M.; van Oers, W. T. H.; Carlson, R. F.; Brown, R. E. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10617 (COO-1265-170, pp 28-39) MEASUREMENT OF ^{3}He + ^{3}He REACTION CROSS SECTIONS. Poppe, C. H.; Brown, R. E.; Hegland, P. M.; Koepke, J. A.; Seshadri, K. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10618 (COO-1265-170, pp 40-43) ODD-EVEN MODEL WITH PAULI REPULSIVE CORE FOR ^{3}H + ^{4}He SCATTERING. Partridge, R. A.; Brown, R. E.; Tang, Y. C.; Thompson, D. R. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10619 (COO-1265-170, pp 56-64) NEUTRONS FROM THE BOMBARDMENT OF ^{3}He BY DEUTERONS AND PROTONS.

Poppe, C. H.; Davis, J. C.; Anderson, J. D.; Grimes, S. M.; Wong, C. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10620 (IN-2P3-CF-74-1, pp 1-14 (Pt.9A)) ONE- OR TWO-NUCLEON TRANSFER REACTIONS INDUCED BY LIGHT IONS. Seltz, R. [nd]. (In French).

From scientific meeting of the Tandem accelerators users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

A survey is given on work in progress for transfer reactions of one or two nucleons induced by light ions at the Orsay and Strasbourg M.P. Tandems. This includes following reactions: (d,p) on ^{27}Al; (^{3}He,d) on ^{27}Al, ^{28}Si, ^{69}Ga, ^{71}Ga, and ^{75}As; (^{3}He,α) on ^{140}Ce, ^{142}Nd and ^{144}Sm; (p,t) on ^{197}Au. (FR)

10621 (IN-2P3-CF-74-1, pp 1-20 (pt. 9B)) THREE-AND FOUR-NUCLEON TRANSFER BY MEANS OF A LIGHT PARTICLE BEAM. Vergnes, M. [nd]. (In French).

From scientific meeting of the Tandem accelerators users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. Mont-Sainte-Odile, 15-17 May 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75-Paris (France)).

A review is given of several multi-nucleon on transfer reactions performed using light projectiles from the Orsay M. P. Tandem. The 3 nucleon transfer reactions (p, α) in the region A approximately 90 and (^{3}He, ^{6}Li) on ^{11}B were studied in order to try to determine their mechanism and to test their usefulness as spectroscopic tools. The 4 nucleon transfer reaction (^{3}He, ^{7}Be), assumed to process through a direct pick-up mechanism, has been used to study the spectroscopic factor S_{α} from ^{12}C to ^{40}Ca and principally for ^{32}S and ^{36}Ar. (FR)

10622 (JINR-R9-7339, pp 207-216) POSSIBLE EXPERIMENTS ON FEW-NUCLEON SYSTEMS ON THE U-120M CYCLOTRON. Vintsour, I.; Presperin, V.; Bem, P. (Ustav Jaderne Fyziky, Rez, Czech.). 1973. (In Russian).

From 3rd symposium on the isochronous cyclotron U-120M and its uses for studies on nuclear physics; Ceske Budejovice, Czechoslovakia (14 May 1973). (Joint Inst. for Nuclear Research, Dubna (USSR)).

The results of polarization experiments published up to 1973 in a system of two to five particles and operational accelerators with polarized beams and targets are summarized. Possibilities for using the U-120M cyclotron for studying small-nucleon system are considered. (INIS)

10623 (JINR-R9-7339, pp 217-223) EXPERIMENTS ON NUCLEON–NUCLEON INTERACTION ON THE U-120M CYCLOTRON. Vintsour, I.; Presperin, V.; Bem, P. (Ustav Jaderne Fyziky, Rez, Czech.). 1973. (In Russian).

From 3rd symposium on the isochronous cyclotron U-120M and its uses for studies on nuclear physics; Ceske Budejovice, Czechoslovakia (14 May 1973). (Joint Inst. for Nuclear Research, Dubna (USSR)).

Results of experiments on nucleon-nucleon interaction, made on the U-120M cyclotron at the Nuclear Physics Institute, are presented. In graphical form are presented data on measurements of differential n-p scattering cross-sections at neutron energies of 23.1 MeV, measurements of coefficients of correlation of polarization in the angular region close to 90° in the center-of-mass system, and coefficients of depolarization. Studies were made on polarized proton targets. Different nuclear reactions served as sources of polarized neutrons. (INIS).

10624 (JUL-Conf-16(Vol.1), pp 89) PICKUP ENERGY SPECTRUM SEEN IN PRODUCING ONE HOLE STATE NUCLEI. Strobel, G. L. (Univ. of Georgia, Athens). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10625 (JUL-Conf-16(Vol.1), pp 90) EXPERIMENTAL STUDY OF HIGHLY EXCITED STATES BY THE (d,^{3}He) REACTION ON p-SHELL NUCLEI. Didelez, J. P.; Chang, C. C.; Bhowmik, R.; Holmgren, H. D.; Steinberg, R. I.; Wu, J. (Univ. of Maryland, College Park). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23--26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10626 (LYCEN-75-02, pp 1-11 (Pt.C3)) GIANT ISOSCALAR RESONANCES IN LIGHT NUCLEI. Abgrall, Y.; Caurier, E. [nd]. (In French).

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10–15 February 1975. (Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire).

The coupled monopole and quadrupole isoscalar vibrations in ^{3}He, ^{16}O, ^{20}Ne, and ^{40}Ca are studied in the generator coordinate method (GCM). The energies, transition rates, degree of collectivity and the electron scattering form factors of the one-phonon GCM states are discussed and compared with the available experimental data as well as with hydrodynamical results. In agreement with experiment, nearly one third of the E0 sum-rule strength lies in the first excited 0^{+} state in ^{4}He and a good description of the inelastic electron scattering form factor is obtained. In ^{16}O and ^{40}Ca the E0 and E2 strengths are mostly concentrated in the one-phonon GCM states. Qualitative differences between spherical and deformed nuclei were found both in the spectra and the spreading of the strengths. (FR)

10627 (LYCEN-75-02, pp 1-4 (Pt.S9)) FUNDAMENTAL STATE OF ^{4}He AND ELECTRON SCATTERING. Caurier, E. [nd]. (In French).

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10–15 February 1975. (Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire).

The generator coordinate method is used to introduce correlations in the ground state of ^{4}He. It is shown that the coupling between monopole and quadrupole correlations allows one to improve the description of the elastic electron form factor. (FR)

10628 SCATTERING OF π^{-} BY ^{3}He. Gonzales-Alio, J. L.; Pascual, R. (Univ., Barcelona). Nuovo Cim., A; 29A: No. 1, 13-29(1 Sep 1975).

The differential and total cross sections π^{-}-^{3}He were studied using Glauber's model. The influence of the different terms of the nuclear wave function and of a repulsive core is calculated. (auth)

10629 EFFECTIVE CHANNEL APPROACH TO NUCLEAR SCATTERING AT HIGH ENERGIES. II. PROTON-HELIUM ELASTIC SCATTERING AT 1 GeV. Rule, D.W.; Hahn, Y. (Department of Physics, University of Connecticut, Storrs, Connecticut 06268). Phys. Rev. C 12: No. 5, 1616-1631 (Nov 1975).

The effective channel formulation of high-energy nuclear reactions is applied to the proton-helium system and the result is compared with experimental data. This formulation provides a consistent procedure for the evaluation of the ground state to effective channel coupling potential, average excitation energy, and the average potential in the effective channel. The effect of coupling to the effective channel as well as the effect of each quantity in that channel are demonstrated. The calculated cross sections were compared to the recent data from Saclay as well as to the earlier Brookhaven data for 1 GeV p-^{4}He elastic scattering. The possibility of using proton-nucleus scattering experiments to obtain a refined estimate of the ratio of the real part to the imaginary part of the proton-nucleon elastic scattering amplitude was investigated. The effect on the calculated cross section due to the uncertainty in the input parameters was carefully analyzed and found to be large enough to obscure the nature of any possible dynamical correlation effects and any possible off-shell effect in the two-body amplitude. (auth)

10630 (p, $2p$) AND (p, pd) REACTIONS ON ^{3}He AT 45.0 MeV. Bunker, S.N.; Jain, M.; Miller, C.A.; Nelson, J.M.; van Oers, W.T.H. (Cyclotron Laboratory, Department of Physics, University of Manitoba, Winnipeg, Manitoba, R3T 2N2). Phys. Rev. C 12: No. 5, 1396-1406 (Nov 1975).

The reactions ^{3}He(p, $2p$) d, ^{3}He(p, pd) p, and ^{3}He(p, $2p$) pn have been studied at 45.0 MeV using a coplanar symmetric geometry. Angular correlations have been obtained for both the ^{3}He(p, $2p$) d and ^{3}He(p, $2p$) d^{*} reactions. Within the framework of the plane-wave impulse approximation (PWIA) the extracted momentum distributions of the $p+d$ and $p+d^{*}$ systems in ^{3}He are compared with predictions calculated using relatively simple wave functions for ^{3}He, d, and d^{*}. Reasonable agreement between the shapes of the extracted and theoretical momentum distributions has been obtained. There exist differences between the momentum distributions extracted from the angular correlation and energy-sharing data. The PWIA predictions overestimate the cross sections by appreciable factors. The ^{3}He(p, pd) quasifree scattering enhancements exhibit shifts in the peak position away from the minimum in the momentum of the spectator

proton. The $^3He(p, 2p)$ *pn* continua are to first approximation in agreement with differential phase-space distribution predictions if the kinematic region of low energy for the relative motion of the unobserved *n-p* pair is excluded. (auth)

10631 CROSS SECTION OF SLOW NEUTRONS ON PARAHYDROGEN. Callerame, J.; Larson, D.J.; Lipson, S.J.; Wilson, R. (Harvard University, Cambridge, Massachusetts 02138). Phys. Rev. C 12: No. 5, 1423-1427 (Nov 1975).

The total cross section of slow neutrons on gaseous parahydrogen has been measured at several temperatures near 20 K and with pressures ranging from 250 to 750 Torr. A previous experiment had suggested that the cross section would exhibit a significant pressure dependence. However, no such pressure dependence was observed. The data give a value for the neutron-proton coherent scattering length of $(-3.733 \pm 0.004) \times 10^{-13}$ cm, in agreement with the latest liquid mirror measurements. (auth)

10632 CROSS SECTION OF SLOW NEUTRONS ON ORTHODEUTERIUM. Callerame, J.; Larson, D.J.; Lipson, S.J.; Wilson, R. (Harvard University, Cambridge, Massachusetts 02138). Phys. Rev. C 12: No. 5, 1428-1431 (Nov 1975).

The total cross section of slow neutrons on gaseous orthodeuterium has been measured near 22 K and at pressures ranging from 145 to 300 Torr. The results give rise to a set of values for the neutron-deuteron scattering lengths that are in significant disagreement with the latest liquid mirror measurements. The relationship between the scattering lengths was found to be: $(2a_4 + a_2)^2 + (5/4)(a_4 - a_2)^2 = (2.313 \pm 0.003) \times 10^{-24}$ cm^2. (auth)

10633 MEASUREMENT OF THE NEUTRON–PROTON SPIN CORRELATION PARAMETER A/sub yy/. Johnsen, S. W. Davis, CA; Univ. of California (1975). 121p. University Microfilms Order No. 75-22,851.

Thesis (Ph. D.).

Recent phase-shift fits to nucleon-nucleon scattering data were examined and indicate the desirability of measuring the neutron-proton spin correlation parameter A/sub yy/ at 50 MeV. Such information is useful in determining the epsilon$_1$ mixing parameter. A polarized proton target was constructed to carry out the measurement. The target employs a crystal of Lanthanum-Magnesium-Nitrate and achieves proton polarizations near 50 percent. A computer controlled NMR system was developed to measure the target polarization. A scattering experiment was performed with the polarized proton target placed in the polarized neutron beam at the Crocker Nuclear Laboratory. Elastically recoiling protons were detected corresponding to neutron center-of-mass scattering angles of 174^0, 155^0, 130^0, and 109^0. The differences in counting rates for various orientations of beam and target polarizations were measured. Using the measurement of these asymmetries, the value of A/sub yy/ at the above neutron scattering angles has been determined. This is the first time A/sub yy/ has been observed for neutron-proton scattering near 50 MeV. (Diss. Abstr. Int., B)

10634 SEARCH FOR A NARROW RESONANCE IN ^{6}Be WITH THE ^{4}He(^{3}He,n) REACTION. Viefers, W.; Witsch, W. von (Bonn Univ. (F. R. Germany). Inst. fuer Strahlen- und Kernphysik); Richter, A. (Technische Univ. Darmstadt (F. R. Germany). Inst. fuer Kernphysik). Nucl. Phys., A; 248: No. 3, 518-523(1 Sep 1975).

The ^{4}He(^{3}He,n)^{6}Be reaction has been investigated at 36.20 MeV bombarding energy in search for a narrow resonance near the ^{3}He–^{3}He threshold which has been proposed as a possible explanation for the missing solar neutrinos in Davis' experiment. Neutrons have been detected at $\theta_n = 0°$ with an effective resolution <25 kev in the c.m. system, in coincidence with protons emitted at $\theta_p = 50°$. No indication for the existence of such a resonance has been found, and an upper limit $(d\sigma/d\Omega)_{res} \leq 7.5$ μb/sr has been established. (NL)

10635 ISOSPIN PURITY OF THE 5.37 MeV STATE IN ^{6}Li. Witsch, W. von (Bonn Univ. (F. R. Germany). Inst. fuer Strahlen- und Kernphysik); Mutchler, G. S.; Miljanic, D. (Rice Univ., Houston, Tex. (USA). Bonner Nuclear Labs.). Nucl. Phys., A; 248: No. 3, 485-495(1 Sep 1975).

The ^{6}Li(p,pα)d, ^{6}Li(p,pα)np, and ^{6}Li(p,pp)^{5}He(g.s.) reactions were measured at 11 and 12 MeV bombarding energy, $\theta_1 = 135°$ and $\theta_2 = 30°$. In the coincidence spectra, final state interactions (FSI) corresponding to the $J^\pi = 2^+$ doublet in ^{6}Li were clearly seen, and their widths and energy positions determined. In addition, the p-α spectrum gives evidence for a level in ^{6}Li at 5.7 MeV excitation with a width of approximately 1 MeV. No indication for decay of the ^{6}Li(5.37 MeV, 2^+, T = 1) state in the d-α channel was found. By comparing the corresponding yields in the isospin allowed and forbidden channels, an upper limit of $\alpha^2 \leq 8 \times 10^{-3}$ was deduced for a possible T = 0 admixture in the T = 1 state at 5.37 MeV. (NL)

10636 RECENT DEVELOPMENT IN NUCLEON-NUCLEUS INTERACTIONS AT INTERMEDIATE ENERGIES. Igo, G. (Univ. of California, Los Angeles). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 63-101(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Some recent experimental results and theoretical calculations on elastic, inelastic and quasi-elastic scattering, and on the pickup reaction are discussed: p-^{4}He and p-^{3}He elastic scattering, comparison of p-d and p-^{4}He backward scattering, the ^{12}C(p,d)^{11}C* reaction, elastic scattering from the isotopes of calcium, elastic and inelastic scattering from several elements, quasi-elastic knock-out of alpha particles from nuclei. (auth)

10637 OBSERVATION OF TWO PHOTONS IN n-p CAPTURE. Dress, W. B. Jr. (Oak Ridge National Lab., TN). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 203-210(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The observation of two gamma rays in coincidence following the capture of subthermal neutrons by protons in water is reported. The measured branching ratio of two-gamma events to single gamma events in the energy range of 600 to 1620 keV was found to be 0.0011 +- 0.0002. Possible sources of systematic error are also considered. (auth)

Nuclear Properties and Reactions, 6 ≤ A ≤ 19

Refer also to abstracts 10625, 10626, 10634, 10703, 11002, 11014, 11020, 11022, and 11025.

10638 (CEA-CONF-3056) MULTI-STEP PROCESSES IN HEAVY ION TRANSFER REACTIONS. Low, K. S. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire). 1975. 34p. (CONF-750137-1). Dep. NTIS (US Sales Only) $4.75.

From 13th international winter meeting on nuclear physics; Bormio, Italy (21 Jan 1975).

The study of reaction mechanisms involved in heavy ion reactions in the last few years has been surveyed in the expectation that these reactions can be used as viable spectroscopic tool. It has been found that not only recoil effect must be taken into account properly, but multi-step processes play a very important role in these reactions also. The importance of CCBA in reactions involving collective nuclei has been examined and the possibility of successive transfer mechanism as described by the CRC has been seen. Such studies are necessarily as complicated or even more so than light ion reactions but a numerical method of overcoming such a problem has been shown. On the other hand, most of the experiments are performed with relatively poor energy resolution. But with the ever improving detection techniques, it is a matter of time before it will perform as well as in light ion reactions. (14 figures) (auth)

10639 (CEN-TS-74-4) STUDY OF THE DIRECT MONOPOLE CAPTURE. Lavielle, C. (Bordeaux-1 Univ., 33 – Gradignan (France). Centre d'Etudes Nucleaires; Bordeaux-1 Univ., 33 (France)). 1974. 69p. (In French). INIS.

The purpose is to compute theoretically and to measure experimentally the cross section for monopole capture of α particles by ^{12}C. Such a capture gives an electron positron pair π. A program to compute the wave functions, the matrix elements, and the cross sections was developed and tested by computations of dipole captures and comparing the results with some of others' work. It was then applied to the study of the reactions $\alpha(^{12}C,\pi)^{16}O$. The calculations gave an upper limit for the cross sections of 10^{-1} nb. An experiment was carried out with the Van de Graaff at the Centre d'Etudes Nucleaires de Bordeaux-Gradignan. The beam energy was 2 MeV, and the observed spectrum gave only an upper limit of 10 nb. Thus, the experimental and theoretical results gave only upper limits, nevertheless, these results are compatible with each other. This work enabled one to establish a computer program which can be applied to the study of any direct radiative capture. (FR)

10640 (COO-535-733, pp 2-4) STUDY OF THE ^{9}Be(p,d)^{8}Be REACTION AT 14.5 MeV. Zimmerman, W. R. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10641 (COO-535-733, pp 44-45) STUDY OF THE REACTION $^{16}O(^3He,t)^{16}F$. Cecil, F. E.; Emigh, R. A.; Anderson, R. E.; Peterson, R. J. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10642 (COO-535-733, pp 98-100) 180° ELECTRON SCATTERING FROM ^{14}N. Enssiin, N.; Bendel, W. L.; Fagg, L. W.; Jones, E. C.; Lindgren, R. A. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10643 (COO-535-733, pp 100-103) SECOND PRODUCTION IN THICK TARGET EXPERIMENTS. Anderson, R. E.; Kraushaar, J. J.; Rost, E.; Sparrow, D. A. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10644 (IN-2P3-CF-74-1, pp 1-5 (Pt.6A)) RESONANT BEHAVIOR OF THE ELASTIC $^{12}C-^{16}O$ SCATTERING. Fernandez, B. [nd]. (In French).

From scientific meeting of the Tandem accelerators users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. (Institut National de Physique Nucleaire et de Physique des Particules, 75 - Paris (France)).

The angular distribution for $^{12}C-^{16}O$ elastic scattering at Tandem energies were measured for low energy steps (320 keV c.m.) with an excitation function. The shape of the cross section, especially the oscillation phase, presents few changes in the regions where $\theta < 60°$ and $\theta > 150°$; on the other hand very fast changes in the form are observed as a function of energy, in the intermediate region. The excitation function shows the existence of three resonances. (FR)

10645 (IN-2P3-CF-74-1, pp 1-9 (pt. 6B)) STUDY OF (α, ^{8}Be) REACTIONS ON ^{12}C, ^{16}O NUCLEI. Disdier, D. [nd]. (In French).

From scientific meeting of the Tandem accelerators users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. Mont-Sainte-Odile, 15-17 May 1974. (Institut National de Physique et de Physique des Particules, 75-Paris (France)).

$^{12}C(\alpha, ^8Be)^8Be$ and $^{16}O(\alpha, ^8Be)^{12}C$ reactions have been studied in the α-energy range 19-27 MeV. In the former case, members of the 8p-8h rotational band were searched for. No evidence was found for the existence of a 8^+ member of this band, in the investigated energy region. In the latter case, a large number of resonances are observed in the excitation function. (FR)

10646 (INIS-mf-1544, pp 85-86) DETERMINATION OF THE (n,t) CROSS SECTIONS AT THE 14.7 MeV NEUTRON ENERGY MEASURING THE TRITIUM β-RADIOACTIVITY. Biro, T.; Shudar, Sh.; Scikai, J.; Dezho, Z. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Determinations were made of the (n,t) reaction cross-sections for the ten elements Be, B, C, Al, Ti, Fe, Co, Ni, Cu and Zn with 14.7 MeV neutrons by measuring the beta activity of the tritium. The neutrons were obtained from the H-3 (d,n) He-4 reaction with an irradiation time of 1 to 50 hours. (tr-auth)

10647 (INIS-mf-1544, pp 104-107) STUDY INTO GAMMA RADIATION FOLLOWING THE 14.9 MeV NEUTRON SCATTERING BY ^{12}C NUCLEI. Polyarkov, V. A.; Prokopets, G. A.; Strizhak, V. I. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

By means of a time-amplitude converter a study was made of the coincidence of gamma radiation with neutrons scattered by a C-12 sample. It was found that a low-energy gamma emission accompanies a quasielastic scattering of neutrons by C-12 nuclei. (tr-auth)

10648 (INIS-mf-1544, pp 233-242) NEUTRON DIFFUSION IN THE ENERGY RANGE 8.5 TO 11 MeV FOR ^{12}C. Hacuat, G.; Cocu, F. (CEA, Paris). 1974. (In French).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The scattering of fast neutrons on C-12 is investigated. Here a presentation is made of measured values of the elastic and inelastic differential cross-sections (for the first level 2^+ at 4.439 MeV) for neutrons having energies of 8.55 ± 0.06, 9.05 ± 0.05, 10.00 ± 0.04 and 10.97 ± 0.04 MeV. (tr-auth)

10649 (JUL-Conf-16(Vol.1), pp 1) GIANT QUADRUPOLE RESONANCE IN LIGHT NUCLEI VIA DEUTERON INELASTIC SCATTERING. Chang, C. C.; Didelez, J. P.; Kwiatkowski, K.; Wu, J. (Univ. of Maryland, College Park). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10650 (JUL-Conf-16(Vol.1), pp 2) SEARCH FOR ISOVECTOR GIANT E2 STATES IN ^{12}C AND ^{16}O. Warburton, E. K.; Noe, J. W.; Snover, K. A.; Suffert, M.; Kuan, H. M. (SUNY, Stony Brook, NY). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23--26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10651 (JUL-Conf-16(Vol.1), pp 4) GIANT ISOSCALAR QUADRUPOLE RESONANCE IN ^{16}O. Breuer, H. (Max-Planck-Institut fuer Kernphysik, Heidelberg, Ger.); Knoepfle, K. T.; Mayer-Boericke, C.; Rogge, M.; Wagner, G. J. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10652 (JUL-Conf-16(Vol.1), pp 5) ISOSCALAR QUADRUPOLE STRENGTH IN ^{16}O THROUGH INELASTIC ALPHA SCATTERING. de Voigt, M. J. A.; Arends, A.; Harakeh, M. N.; Drentje, A. G.; van der Werf, S. Y.; van der Woude, A. (Univ. of Groningen, Netherlands). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10653 (JUL-Conf-16(Vol.1), pp 6) HIGHER GIANT MULTIPOLE RESONANCES OF ^{16}O. Geramb, H. V. (Inst. fuer Kernphysik, Juelich, Ger.); Sprickmann, R.; Lebrun, D.; Perrin, G.; Martin, P.; de Saintignon, P.; Arvieux, J.; Buenerd, M.; Escudie, J. L.; Tarrats, A. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10654 (JUL-Conf-16(Vol.1), pp 7) GIANT RESONANCE EFFECTS FROM DIFFERENTIAL CROSS SECTIONS AND ANALYZING POWER DATA FOR $^{16}O(p,p')^{16}O^*(2^-, 8.88\ MeV)$. Lebrim, D. (Univ., Grenoble, France); Buenerd, M.; Perrin, G.; Arvieux, J.; Sprickmann, R.; von Geramb, H. V. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10655 (JUL-Conf-16(Vol.1), pp 8) E2 STRENGTH IN NUCLEI OBSERVED WITH POLARIZED PROTON CAPTURE REACTIONS. Hanna, S. S.; Glavish, H. F.; Calarco, J. R.; LaCanna, R.; Kuhlmann, E.; Mavis, D. G. (Stanford Univ., CA). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10656 (JUL-Conf-16(Vol.1), pp 9) ISOSCALAR E2 STRENGTH IN NUCLEI OBSERVED IN ALPHA CAPTURE REACTIONS. Hanna, S. S.; Calarco, J. R.; Kuhlmann, E.; Ventura, E.; Mavis, D. G. (Stanford Univ., CA). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

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Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10657 (JUL-Conf-16(Vol.1), pp 10) STRUCTURES AND WIDTHS OF HIGHER MULTIPOLE GIANT RESONANCES. Krewald, S.; Birkholz, J.; Faessler, A.; Speth, J. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10658 (JUL-Conf-16(Vol.1), pp 11) EFFECTIVE MASSES FOR ISOSCALAR VIBRATIONS: BREATHING MODE. Brink, D. M. (Dept. of Theoretical Physics, Oxford); Engel, Y. M.; Goeke, K.; Krieger, S. J.; Vautherin, D. Jul 1975.
From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10659 (JUL-Conf-16(Vol.1), pp 80) FURTHER EVIDENCE FOR RESONANCE ANOMALIES IN THE $^{16}O + ^{12}C$ SYSTEM. Branford, D.; Newton, J. O.; Nagorcka, B. N.; Robinson, J. M. (Australian National Univ., Canberra). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10660 (JUL-Conf-16(Vol. 1), pp 81) METHOD FOR DETERMINATION OF CRITICAL L-VALUES OR YRAST SPINS. Klapdor, H. V.; Reiss, H.; Rosner, G. (Max-Planck-Institut fuer Kernphysik, Heidelberg, Ger.). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10661 (JUL-Conf-16(Vol.1), pp 91) INVESTIGATION OF DEEP-LYING HOLE-STATES BY THE (d,^{3}He) REACTION AT E_d = 80 MeV. Rogge, M.; Knoepfle, K. T.; Mayer-Boericke, C.; Schwinn, U.; Turek, P. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10662 (JUL-Conf-16(Vol.1), pp 92) DEEP LYING HOLE STATES IN ^{11}C, ^{15}O, ^{27}Si, AND ^{57}Ni WITH THE (^{3}He,α) REACTION AT 216 MeV. Gerlic, E.; Langevin-Joliot, H.; Roos, P.; Van de Wiele, J.; Didelez, J. P.; Duhamel, G. (Inst. de Physique Nucleaire, Orsay, France). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10663 (JUL-Conf-16(Vol.1), pp 93) DEEPLY BOUND NEUTRONS IN LIGHT NUCLEI. Geramb, H. V.; Hefter, E. F. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10664 (JUL-Conf-16(Vol.1), pp 95) WHY ONE FINDS A VIOLATION OF KOLTUN'S SUM RULE. Faessler, A. (Inst. fuer Kernphysik, Juelich, Ger.); Krewald, S.; Wagner, G. J. Jul 1975.
From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10665 (JUL-Conf-16(Vol.1), pp 101) α^*-STRUCTURE IN α-LIKE NUCLEI. Hackenbroich, H. H.; Seligman, T. H.; Zahn, W. (Univ., Cologne). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10666 (JUL-Conf-16(Vol.1), pp 104) QUASIMOLECULAR STATES IN ELASTIC α-SCATTERING. Friedrich, H.; Fiebig, H.; Langanke, K.; Weiguny, A. (Univ., Muenster, Ger.). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10667 (JUL-Conf-16(Vol.1), pp 105) SELECTIVE POPULATION OF HIGHLY EXCITED STATES OF ^{15}N BY $^{12}C(\alpha,p)^{15}N$ REACTION. Djaloeis, A.; Ingham, D.; Falk, W. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10668 (LRB-75-02) HIGH RESOLUTION LASER SPECTROSCOPY OF THE D LINES OF ON-LINE PRODUCED ^{21}Na, ^{22}Na, ^{24}Na, ^{25}Na USING A NEW HIGH SENSITIVITY METHOD OF DETECTION OF OPTICAL RESONANCES. Huber, G.; Thibault, G.; Klapisch, R.; Duong, H. T.; Vialle, J. L.; Pinard, I.; Juncar, P.; Jacquinot, P. (Centre National de la Recherche Scientifique, 91 – Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). 1975. 10p. INIS.
A polyisotopic sodium beam of $^{21-25}Na$, produced by spallation of Al, was illuminated by a tunable dye laser. The atomic beam, analyzed by a sixpole magnet is then ionized and detected after a mass spectrometer. The results are the isotope shifts, nuclear magnetic moment and quadrupole moment of ^{25}Na. (FR)

10669 (LRB-75-03) DIRECT MEASUREMENT OF MASSES OF ^{11}Li AND $^{26,27,28,29,30,31,32}Na$ WITH AN ON-LINE MASS SPECTROMETER. Thibault, C.; Klapisch, R.; Rigaud, C.; Poskanzer, A. M.; Prieels, R.; Lessard, L.; Reisdorf, W. (Centre National de la Recherche Scientifique, 91 – Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). 1975. 40p. INIS.
The use of an on-line mass spectrometer to make direct mass measurements on short-lived isotopes far from the stability line has been improved to yield more accurate mass measurements for $^{27-30}Na$, new mass measurements for ^{31}Li, ^{31}Na, ^{32}Na and to remove a discrepancy between existing mass measurements of ^{26}Na. (FR)

10670 (LRB-75-06) CROSS SECTIONS FOR THE PRODUCTION OF Li AND Be ISOTOPES IN CARBON TARGETS IRRADIATED BY 300 GeV PROTONS. Raisbeck, G. M.; Lestringuez, J.; Yiou, F. (Centre National de la Recherche Scientifique, 91 – Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). 1975. 7p. INIS.
Cross sections for the production of Li and Be isotopes in carbon targets irradiated by 300 GeV protons have been measured by mass spectrometry. The results are compared with lower energy measurements and discussed in terms of the variation of the cosmic ray L/M ratio in the energy region. (FR)

10671 (LRB-75-07) PRODUCTION CROSS SECTIONS OF Be ISOTOPES IN C AND O TARGETS BOMBARDED BY 2.8 GeV ALPHA PARTICLES: IMPLICATIONS FOR FACTORIZATION. Raisbeck, G. M.; Yiou, F. (Centre National de la Recherche Scientifique, 91 – Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). 1975. 9p. INIS.
The production cross sections of ^7Be in C and O, and ^9Be and ^{10}Be in C targets irradiated by 2.8 GeV alpha particles have been measured. The results are discussed in terms of the applicability of a factorization relationship proposed for high energy nuclear cross sections. (FR)

10672 EXPERIMENT ON ISOSPIN-CHANGING PARITY VIOLATION INVOLVING HADRONS IN NUCLEI. Bellotti, E. (Univ., Milan); Fiorini, E.; Negri, P.; Pullia, A.; Zanotti, L.; Filosofo,I. Nuovo Cim., A; 29A: No. 1, 106-122(1 Sep 1975).
An experiment is reported on the parity-violating reaction $d(\alpha,\gamma)^6Li$, leading to the $J^P = 0^+$, I = 1, E_x = 3.562 MeV state, which, being a $\Delta I = 1$ transition, could be strongly enhanced by the presence of neutral currents in hadronic weak interactions in nuclei. The experiment was carried out by exposing a deuterium target to a beam of α-particles reaching the resonant energy in the region in the middle of the tube containing the gas. γ-rays from this region are detected by a 90 cm^3Ge(Li) counter connected to a 4096 channel analyzer through an amplifying and analyzing

chain. The various sources of the background of spurious counting in the Ge(Li) and the procedure adopted to reduce their effect are discussed. No evidence was found for a nonzero parity-violating width of the 3.562-MeV state of ^{6}Li and can set an upper limit for this width of $8 \cdot 10^{-4}$ eV, which is an order of magnitude or more lower than that obtained in the previous experiments on this reaction. (auth)

10673 T(^{3}He,n)^{5}Li REACTION AT ^{3}He ENERGIES BELOW 5.5 MeV. Abbondanno, U. (Univ., Trieste, Italy); Demanins, F.; Tuniz, C.; Nardelli, G. Nuovo Cim., A; 29A: No. 2, 187-198 (21 Sep 1975).

A measurement of the angular distributions of neutrons emitted in the two-proton transfer reaction T(^{3}He,n)^{5}Li is described. The data were obtained by using the pulsed-beam time-of-flight technique at energies of the incident ^{3}He particles from 2.0 to 5.5 MeV, in steps of 0.5 MeV. The experimental data for the neutrons from the ground state ($J^{\pi} = \frac{3}{2}^{-}$, $\Gamma = (2.03 \pm 0.15)$ MeV) and first excited state ($J^{\pi} = \frac{1}{2}^{-}$, $E_x = (10.21 \pm 0.28)$MeV, $\Gamma = (1.49 \pm 0.61)$ MeV) of ^{5}Li are compared to theoretical curves calculated assuming an angular momentum transfer $J^{T} = 1$. A reasonable agreement was obtained between measured and calculated quantities. (auth)

10674 MULTICHANNEL FADDEEV EQUATIONS AND ITS APPLICATION TO THE ^{9}Be BOUND STATES. Chuu, D. S.; Han, C. S. (National Chiao-Tung Univ., Taiwan). Chin. J. Phys. (Taiwan); 13: No. 1, 59-68(Apr 1975).

The binding energies of the ground state $\frac{3}{2}^{-}$ and an excited state $\frac{1}{2}^{+}$ of ^{9}Be are calculated on a multichannel three-body model in which the internal structure of the α particle is approximately represented by a two-state system. In this calculation the $n\alpha$ interaction is represented by a 2×2 matrix, and the $\alpha\alpha$ interaction, by a 3×3 matrix. Both potentials are l-dependent and determined from the two-body scattering data at low energies. (5 figures, 5 tables) (auth)

10675 FRAMEWORK FOR LOW ENERGY NUCLEAR SCATTERING. II. Complex Poles in the Impact Parameter Plane and ^{12}C(p,p)^{12}C. Gupta, K.; Chowdhury, A. R.; Roy, T. (Jadavpur Univ., Calcutta). J. Phys., G (London); 1: No. 6, 652-656(1 Aug 1975).

p-C^{12} elastic scattering is studied on the basis of a peripheral resonance model in the impact parameter representation. As a sequel to the formulation in a previous communication, the important connection between the two approaches of complex poles in the impact parameter plane and Regge poles in the direct channel is discussed. Consistency with the experimental data was observed for a number of beam energies for p-C^{12} scattering. (auth)

10676 SPECTROSCOPIC FACTOR FOR THE ^{20}F 0.655 MeV STATE FROM THE ^{19}F(d,p)^{20}F REACTION. Comsan, M. N. H.; El-Kamhawy, A. A.; Asfour, F.; Abd-El-Fattah, M. (Atomic Energy Establishment, Cairo (Egypt). Dept. of Nuclear Physics). Atomkernenergie; 26: No. 1, 37-40(1975).

2 figs.; 4 tabs.; 27 refs.

Angular distributions for the protons from the ^{19}F(d,p)^{20}F reaction leading to the 0.655 MeV excited state of ^{20}F have been measured at six deuteron energies from 1.20 to 2.20 MeV in steps of five degrees. An analysis of the data has been made using the DWBA theory. Correct peak position over the measured energy interval could be predicted when the depth of the real part of the deuteron optical potential was allowed to be energy-dependent. The average value of the spectroscopic factors deduced over the energy interval was found to be 0.68 ± 0.12 which is good agreement with the predictions of shell-model calculations based upon a ^{16}O closed core. (auth)

10677 DECAY OF THE T = 1 ISOSPIN TRIPLET IN A = 12 SYSTEMS. Behrens, H.; Szybisz, L. (Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Experimentelle Kernphysik; Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Z. Phys., A.; 273: No. 2, 177-183(Jun 1975).

2 figs.; 4 tabs.; 43 refs.

A complete theoretical study is carried out of the beta decays of the ^{12}B and ^{12}N ground states to the ^{12}C ground state. We calculated the form factor coefficients F (N,KLs) using the Cohen-Kurath wave functions. In particular, we obtained reasonable values for the axial F(0.101) and vectorial F(0.111) form factor coefficients whose ratio contains the influence of the weak magnetism constant. It is shown that in this way the measurements of the shape factors presented by Wu and co-workers can be explained. In addition, it is demonstrated that the contribution of the term proportional to $(WR)^2$ cannot be completely neglected because of the large end point energy W_0. From the vectorial form factor F(0.111) we have derived the radiative width of the isobaric analog γ transition from the excited state ^{12}C* to the ground state of ^{12}C. The result is in good agreement with the experimental data. For both beta transitions we have evaluated the ft values which are in good agreement with the experimental values. It is confirmed that the difference between the ft values for both beta transitions can be accounted for by binding energies effects. (auth)

10678 ANALYSIS OF THE ^{16}O(d,d)^{16}O ELASTIC SCATTERING IN THE DEUTERON ENERGY RANGE 1.0 TO 2.5 MeV. Bondouk, I. I. (Atomic Energy Establishment, Cairo (Egypt). Dept. of Nuclear Physics); Duma, M. (Institute of Atomic Physics (Romania)). Atomkernenergie; 26: No. 1, 41-42(1975).

1 fig.; 7 refs.

The ^{16}O(d,d)^{16}O elastic scattering data of F. Machali et al. have been analyzed in terms of the optical model and a resonance term obtained from the single level approximation theory. (auth)

10679 STUDY OF Be^{9}(d,p), (d,t) AND (d,α) REACTIONS. Cheng-lie, J.; Kui, Z.; Da-zhuang, W.; Wei-jiang, L.; En-chen, Z.; Zhi-chang, L.; Dun-jiu, C.; Ye-hao, C.; Fu-bao, L.; Shu-kui, H. Chin. J. Phys. 23: No. 5, 227-236 (Sept 1974).

The reactions Be^{9}(d,p$_0$)Be^{10}(0), Be^{9}(d,p$_1$)Be^{10}(3.368 MeV), Be^{9}(d,t$_0$)Be^{9}(0), Be^{9}(d,α_0)Li^{7}(0), and Be^{9}(d,α_1)Li^{7} (0.478 MeV) were studied at deuteron bombarding energies ranging from 0.1 to 2.5 MeV. The angular distributions of the outgoing particles of these five reactions were measured, respectively, between $\theta_L = 10°$ and 155° at eleven bombarding energies E_d:0.150, 0.220, 0.401, 0.706, 1.005, 1.301, 1.484, 1.750, 2.000, 2.250, and 2.500 MeV. The excitation functions of the reaction Be^{9}(d,p$_0$)Be^{10} were measured at $\theta_L = 135°$, with E_d from 0.1 to 2.5 MeV, at $\theta_L = 95°$ with E_d from 0.1 to 2.2 MeV, and $\theta_L = 112.5°$ with E_d from 0.5 to 2.5 MeV, respectively. By using thicker targets (100-300 μg/cm^2), the absolute cross sections of the reaction Be^{9}(d,p$_0$)Be^{10} with $E_d = 1.2$ MeV, were measured at $\theta_L = 135°$ and 112.5°. The results were $\sigma_{p0}(\theta_L = 135°) = 1.60$ mb/sr and $\sigma_{p0}(\theta_L = 112.5°) = 1.55$ mb/sr. Thus, the behaviors of the cross sections of all five groups of outgoing particles were known in this energy range. Results are discussed. (auth)

10680 *E*1 EXCITATIONS IN $A = 15$ NUCLEI. Harakeh, M.H.; Paul, P. (Physics Department, State University of New York, Stony Brook, New York 11794); Kuan, H.M.; Warburton, E.K. Phys. Rev. C 12: No. 5, 1410-1422 (Nov 1975).

The ^{14}C(p, γ)^{15}N reaction was studied from $E_p = 2.8$ to 30 MeV corresponding to $E_x = 13$ to 38 MeV in ^{15}N covering the region of the lowest $T = 3/2$ states as well as the giant dipole resonance (GDR). The ^{14}N(p, γ)^{15}O reaction measurements were extended for excitation regions from $E_x = 24$–33.5 MeV thus covering the analogous regions in ^{15}O and ^{15}N. Angular distributions obtained in the first reaction at the resonance energies of $E_p = 4.83$, 5.62, 6.65, 6.925, 10.0, 11.0, 12.35, 13.6, and 16.4 MeV indicated large negative a_2 coefficients in all cases. The new narrow ($\Gamma_{c.m.} = 90$ keV) resonance at 6.925 MeV has $J^{\pi} = 3/2^{+}$ and $T = 1/2$. A careful comparison of the ^{15}N(γ, p_0)^{14}C and ^{15}O(γ, p_0)^{14}N reactions is used to extract the $T = 3/2$ and 1/2 components of the GDR in $A = 15$. Most of the $T = 3/2$ *E*1 strength is located near $E_x = 26$ MeV. A microscopic calculation of $J^{\pi} \leq 5/2^{+}$ states with $T = 1/2$ and 3/2 in a 2h-1p and 1h basis of good isospin gives good agreement with the observed depleted B (*E*1) values from the lowest $T = 3/2$ states and reproduces the location of the collective $T = 3/2$ *E*1 states near 26 MeV. It also describes well the distribution of $T = 1/2$ collective *E*1 strength. Using this agreement with the theory which contains no adjusted parameters an effective symmetry potential of $U = 28$ MeV is extracted from the isospin energy splitting. This value is smaller than the typical 60 MeV found in heavier nuclei but agrees with a recent model-independent limit and with other cases of $|T_z| = 1/2$ nuclei. (auth)

10681 RESONATING-GROUP STUDY OF $N + {}^{16}$O SCATTERING WITH A GENERATOR-COORDINATE TECHNIQUE. Thompson, D.R.; Tang, Y.C. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455). Phys. Rev. C 12: No. 5, 1432-1446 (Nov 1975).

The scattering of nucleons by ^{16}O is studied with the resonating-group method. The ^{16}O wave function used is a translationally invariant antisymmetrized product of single-particle wave functions of $(1s)^4(1p)^{12}$ configuration in a harmonic-oscillator well having an appropriately chosen width parameter. A generator-coordinate technique is employed to facilitate the computation of the nonlocal interaction between the nucleon and the ^{16}O nucleus. This technique is discussed in some detail in order to demonstrate its utility in a nuclear problem involving a relatively large number of nucleons. Calculated results are compared with experimental data over a wide range of energies, and it is found that the agreement is in general quite satisfactory. Also, the result shows that in this particular problem the heavy-particle pickup process, which is properly taken into consideration by the use of a totally antisymmetric wave function, has a relatively small contribution. (auth)

10682 HALF-LIVES OF ^{18}Ne AND ^{20}F. Alburger, D.E. (Brookhaven National Laboratory, Upton, New York 11973); Calaprice, F.P. Phys. Rev. C 12: No. 5, 1690-1691 (Nov 1975).

The half-lives of ^{18}Ne and ^{20}F have been measured by multiscaling β rays detected in a plastic scintillator. ^{18}Ne was formed in the ^{16}O(^{3}He, n)^{18}Ne reaction at $E_{^3He}$=5.7 MeV using a $Ta_2{}^{16}O_5$ target depleted in ^{17}O and ^{18}O. ^{20}F was produced in the ^{19}F(d, p)^{20}F reaction with 2.0-MeV deuterons on a BaF_2 target. Half-life values of 1.669±0.004 sec for ^{18}Ne and 10.996±0.020 sec for ^{20}F were obtained. Using the present and other recent results the A=18 β decay mirror asymmetry is found to be −0.86±0.80%. (auth)

10683 ISOSPIN MIXING IN DEFORMED NUCLEI. Wang, D.; Friedman, W.A. (Department of Physics, University of Wisconsin, Madison, Wisconsin 53706). Phys. Rev. C 12: No. 5, 1684-1686 (Nov 1975).

The effect of nuclear deformation on the isospin mixing matrix elements has been investigated for deformed configurations in ^{18}F. An enhancement of the mixing with deformation is found. (auth)

10684 TRANSFER REACTIONS WITH HEAVY IONS ON LIGHT NUCLEI. Nair, K.G.; Voit, H.; Towsley, C.W.; Hamm, M.; Bronson, J.D.; Nagatani, K. (Cyclotron Institute, Texas A&M University, College Station, Texas 77843). Phys. Rev. C 12: No. 5, 1575-1585 (Nov 1975).

Proton and neutron transfer reactions resulting from the bombardment of ^{12}C and ^{16}O targets by ^{14}N beams and ^{12}C, ^{14}N, and ^{16}O targets by ^{10}B beams have been studied with counter telescopes and particle identification techniques. The incident energies were far above the Coulomb barrier for these systems: 155 MeV for ^{14}N ions and 100 MeV for ^{10}B ions. Angular distributions have been measured for transitions to the ground states and several excited states in the residual nuclei produced. Ejectile excitations were also observed in some instances. Exact finite range distorted-wave-Born-approximation calculations have been performed for these states which are mostly in the 1p and 2s-1d shells. The extracted spectroscopic factors are generally in good agreement with theoretical predictions and other previously obtained results. However, there are some conspicuous but isolated instances where they are not, pointing towards a need for more sophisticated approaches including core excitations for those cases. Generally the quality of spectroscopic studies with heavy-ion-induced transfer reactions is comparable if not superior to that from the corresponding light-ion-induced reactions. (auth)

10685 MEASUREMENT OF THE MASS OF ^{8}He. Kouzes, R.; Moore, W.H. (Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08540). Phys. Rev. C 12: No. 5, 1511-1515 (Nov 1975).

The ^{64}Ni(^{4}He, ^{8}He)^{60}Ni reaction was used at 58-MeV bombarding energy with the quadrupole-dipole-dipole magnet spectrograph, giving an improved value of the ^{8}He mass excess of 31.611±0.017 MeV. (auth)

10686 SCATTERING OF ELECTRONS ON ^{12}C WITH A KNOCK-OUT OF AN α-PARTICLE AND α-CLUSTER STRUCTURE OF LIGHT NUCLEI. Antonov, A. N. (Inst. of Nuclear Research and Nuclear Energy, Sofia). Bulg. J. Phys.; 2: No. 2, 110-116(1975).

Inelastic scattering of electrons on ^{12}C with a knock-out of an α-particle is investigated. The cross section of the process is calculated on the basis of the α-particle model, in which ^{12}C consists of three α-particles on the vertexes of an equilateral triangle, and ^{8}Be—of two α-particles. The theoretical curves of the cross section are given as a function of the energy ξM. (auth)

10687 MEASUREMENT OF THE MASS OF He 8. Kouzes, R. T. Princeton, NJ; Princeton Univ. (1975). 195p. University Microfilms Order No. 75-23,215.

Thesis (Ph. D.).

A measurement of the Q-value for the ^{64}Ni(^{4}He,^{8}He)^{60}Ni reaction was used to determine the mass excess of ^{8}He. The QDDD spectrograph was used at scattering angles of 10 and 12 degrees with a 13.5 millisteradian solid angle. A 57.8 MeV alpha beam from the Princeton AVF Cyclotron was used with a rolled ^{64}Ni foil target. The reaction cross-section peaks at about 50 nanobarns/steradian near 10 degrees. The result of the measurement of the ^{8}He mass excess was 31.611 +- 0.018 MeV. The importance of the ^{8}He mass to the experimental verification of the isobaric mass multiplet equation is discussed. (Diss. Abstr. Int., B)

10688 RECENT RESULTS ON (gamma,p) REACTIONS IN NUCLEI. Matthews, J. L. (Massachusetts Inst. of Tech., Cambridge). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 437-444 (1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Differential cross sections for the $^{6+7}$Li(gamma,p)$^{5+6}$He, ^{12}C (gamma,p)^{11}B, and ^{16}O(gamma,p)^{15}N processes leading to ground and low lying excited states were measured at a series of photon energies between 40 and 280 MeV. The results are discussed in terms of a simple direct-knockout picture and are seen to provide a means for studying the high momentum behavior of nuclear shell model wave functions. (auth)

Nuclear Properties and Reactions, 20 ≤ A ≤ 38

Refer also to abstracts 9982, 10626, 10638, 10646, 10649, 10655, 10656, 10662, 10664, 10666, 10669, 10682, 10723, 10726, 10727, 10737, 10761, and 10777.

10689 (CEN-BG-74-23) STUDY OF THE EXCITED STATES OF ^{28}Si USING ^{27}Al(p,γ)^{28}Si RADIATIVE CAPTURE. Dalmas, J. (Bordeaux-1 Univ., 33 – Gradignan (France). Centre d'Etudes Nucleaires; Bordeaux-1 Univ., 33 (France)). 1974. 173p. (In French). INIS.

Thesis.

The gamma decay of ^{28}Si levels excited in the ^{27}Al(p,γ)^{28}Si reaction has been investigated in the energy range E_p < 3.5 MeV. Energies and branching ratio studies have been made, as well as mean lifetimes and gamma-ray angular distributions. Emphasis was given to measurements on several levels as possible candidates for the states of rotational bands arising from the SU_3 classification. Apart from the K = 0$^+$ rotational band based on the ground state, the SU_3 previsions are not substantiated, but cannot be definitely rejected, and a few experiments are suggested. On the other hand, many results are consistent with the shell model calculations. (FR)

10690 (COO−1265-170, pp 68-73) SEARCH FOR INELASTIC MONOPOLE TRANSITIONS IN ODD-A NUCLEI. Morsch, H. P.; Artz, J. L.; Dehnhard, D.; Li, T. K. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10691 (COO−1265-170, pp 74-75) INELASTIC QUADRUPOLE TRANSITIONS IN ^{27}Al AND ^{29}Si. Artz, J. L.; Morsch, H. P.; Dehnhard, D. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10692 (COO−1265-170, pp 76-81) MICROSCOPIC COUPLED CHANNEL STUDY OF INELASTIC ^{3}He SCATTERING FROM ^{24}Mg. Morsch, H. P.; Dehnhard, D.; Dudek-Ellis, A.; Ellis, P. J. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10693 (COO−1265-170, pp 152-154) ELASTIC SCATTERING OF ^{16}O ON ^{29}Si AND ^{30}Si AT 60.0 MeV. Shkolnik, V.; Dehnhard, D.; Artz, J. L.; Weber, D. J. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10694 (COO−1265-170, pp 154-158) SMALL ANGLE STRUCTURE IN INELASTIC ^{16}O SCATTERING FROM ^{30}Si. Morsch, H. P.; Artz, J. L.; Dehnhard, D. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10695 (FRNC-TH-534) STUDY OF THE EFFECT OF IMPURITIES IN ION SOLIDS USING NUCLEAR QUADRUPOLE RESONANCE. Vargas, H. (Grenoble-1 Univ., 38 (France)). 1973. vp. (In French). INIS.

Thesis.

The nuclear quadrupole resonance method was used to study the effect of impurities on the electric field gradient in the proximity of ^{35}Cl nuclei in $NaClO_3$, $KClO_3$, and $Ba(ClO_3)_2$. The impurities had been introduced using chemical or mechanical methods or γ irradiation. The measurements were made at 78°K and 298°K. It was shown that nuclear quadrupole resonance was a good means to check if the samples prepared were solid solutions. A decrease in the intensity of the resonance line, as well as spectral shift and line broadening were observed in the presence of impurities. These effects were proportional to the concentration of the impurity; their magnitude, their variation with temperature and the direction of the shift depend on the nature of the impurity. The effects observed were interpreted either as a distorsion of the electric field gradient due to an elastic deformation of the matrix by

the impurity or as a charge transfer between impurities and resonant nuclei. (FR)

10696 (IN-2P3-CF-74-1, pp 1-19 (pt. 4A)) NUCLEAR AND ELECTROMAGNETIC PROPERTIES OF SOME NUCLEI IN THE s-d AND f-p SHELLS. Wagner, P. [nd]. (In French).

From scientific meeting of the Tandem accelerators users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. Mont-Sainte-Odile, 15-17 May 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75-Paris (France)).

Three studies on ^{22}Na, ^{26}Mg, ^{47}V are presented. Decay schemes, branching ratios, lifetimes are deduced from correlation studies Doppler shift attenuation and recoil plunger measurements. The following reactions are used ^{19}F(α, nγ) ^{22}Na, ^{12}C(^{14}C, α)^{22}Na; ^{24}Mg (t, pγ)^{26}Mg, ^{26}Mg(α, $\alpha'\gamma$)^{26}Mg and ^{47}Ti(p, nγ)^{47}V and ^{31}P(^{19}F, p2n)^{47}V. (FR)

10697 (INIS-mf-1544, pp 120-125) CROSS SECTIONS OF GAMMA-QUANTA PRODUCTION IN THE 1.9-4.0 MeV NEUTRON INTERACTION ON Al, Fe, Pb NUCLEI. Degtyarev, Yu. G.; Chulkov, V. V.; Protopopov, V. N. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Measurements were taken of cross-section for the formation of gamma-quanta during the interaction of neutrons having energies from 1.9 to 4.0 MeV on nuclei of Al, Fe and Pb. Measurements were carried out in ring geometry by means of a Ge(Li) gamma-spectrometer. An original method of treating the gamma spectra was used in the study. (tr-auth)

10698 (INIS-mf-1544, pp 187-196) CROSS SECTIONS OF GAMMA RAY PRODUCTION FOLLOWING THE ^{23}Na(n,n'γ), ^{58}Ni(n,n'γ), ^{60}Ni(n,n'γ) REACTIONS. Lachkar, J.; Patin, Y.; Sigaud, J. (CEA, Paris). 1974. (In French).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Gamma-radiation emission resulting from the interaction of fast neutrons with sodium and nickel has been studied. Differential cross-sections were measured for the reactions ^{23}Na(n,n'γ), ^{58}Ni(n,n'γ), and ^{60}Ni(n,n'γ) for the main transitions observed. Gamma radiation was studied with a Ge(Li) detector surrounded by a NaI(Tl) ring. It was discriminated from dispersed neutrons by a time-of-flight method. Differential cross-sections for gamma radiation emission in the ^{23}Na(n,n'γ) reaction were measured with impinging neutrons having energies of 6.3, 7.3, 8.3, and 8.8 MeV. The same measurements were made at energies of 6.3 and 8.8 MeV for ^{58}Ni and ^{60}Ni. In these energy fields, not thoroughly studied yet, agreement of our results with earlier published data was satisfactory. (tr-auth)

10699 (JUL-Conf-16(Vol.1), pp 12) APPROACH TO THE PHOTONUCLEAR RESONANCE PROBLEM IN DEFORMED LIGHT NUCLEI AND ITS APPLICATION TO ^{20}Ne. Schmid, K. W.; Do Dang, G. (Universite de Paris, Orsay, France). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10700 (JUL-Conf-16(Vol.1), pp 13) GIANT RESONANCES IN INELASTIC PROTON SCATTERING ON ^{24}Mg. Lovas, I.; Rogge, M.; Schwinn, U.; Turek, P.; Ingham, D.; Mayer-Boericke, C. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10701 (JUL-Conf-16(Vol.1), pp 14) ANALYSIS OF E2 RADIATIVE α-CAPTURE AND GIANT QUADRUPOLE RESONANCES. Shikazono, N.; Terasawa, T. (Australian National Univ., Canberra). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10702 (JUL-Conf-16(Vol.1), pp 34) HIGH-SPIN STATES IN LIGHTER s-d SHELL NUCLEI. Wildenthal, B. H.; Chung, W. (Michigan State Univ., East Lansing). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10703 (JUL-Conf-16(Vol.1), pp 35) GAMMA DECAY OF HIGH STATES IN ^{23}Na. KeKelis, G. J. (Florida State Univ., Tallahassee); Fox, J. D.; Lumpkin, A. H.; van Rinsvelt, H. (Florida State Univ., Tallahassee). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10704 (JUL-Conf-16(Vol.1), pp 83) MASS YIELDS OF ^{35}Cl-INDUCED REACTIONS AT ABOUT 100 MeV. Hille, P. (Inst. fuer Radiumforschung und Kernphysik, Vienna); Rudolph, K.; Hille, M.; Sperr, P.; Muenzer, H.; Mannhart, W.; Gaul, G. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10705 (JUL-Conf-16(Vol.1), pp 84) PRE-EQUILIBRIUM NEUTRON SPECTRA. Doering, R.R. (Michigan State Univ., East Lansing); Galonsky, A.; Patterson, D.M.; Serr, F.; Blann, M. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10706 (JUL-Conf-16(Vol.1), pp 96) LIFETIME OF NUCLEAR HOLE STATES CAUSED BY PHONON-HOLE COUPLING. Doll, P.; Knoepfle, K. T.; Mairle, G.; Wagner, G. J. (Max-Planck-Inst. fuer Kernphysik, Heidelberg, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10707 (JUL-Conf-16(Vol.1), pp 102) LARGE-ANGLE SCATTERING OF α-PARTICLES FROM Ne ISOTOPES. Cowley, A. A.; Heymann, G.; van Staden, J. C.; Burdzik, G. F.; Mills, S. J. (CSIR, Pretoria). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10708 (JUL-Conf-16(Vol.1), pp 103) RESONANCES IN ELASTIC α-SCATTERING ON ^{40}Ca. Eickhoff, H. (Univ., Muenster, Ger.); Frekers, D.; Gaul, G.; Loehner, H.; Poppensieker, K.; Santo, R.; Mayer-Boericke, C.; Turek, P. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10709 (JUL-Conf-16(Vol.1), pp 106) SELECTIVE POPULATION OF HIGHLY EXCITED STATES IN ^{24}Mg(α,p)^{27}Al REACTION. Zybert, R.; Budzanowski, A.; Ploskonka, J.; Skwirczynska, I.; Strzalkowski, A.; Zybert, L. (Jagellonian Univ., Krakow). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10710 (JUL-Conf-16(Vol.1), pp 107) SPECTROSCOPY OF HIGHLY EXCITED SITES IN ^{39,41}K AND ^{41,43}Ca using (α,p) AND (α,n) REACTIONS ON SOLID ARGON TARGETS. Sharpey-Schafer, J. F.; Brown, A. J.; James, A. N.; Lister, C. J.; Nolan, P. J. (Univ. of Liverpool, Eng.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10711 (JUL-Conf-16(Vol.1), pp 111) CORE EXCITATION EFFECTS ON THE NOLEN–SCHIFFER ANOMALLY. Gomez, J.M.G.; Poves, A. (Univ., Autonoma de Madrid). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10712 (LRB-75-05) PRODUCTION CROSS SECTIONS FOR ^{7}Be AND ^{22}Na IN Si, Mg, Fe, AND Ni TARGETS IRRADIATED WITH 1, 2, 3, AND 23 GeV PROTONS. Raisbeck, G. M.; Yiou, F. (Centre National de la Recherche Scientifique, 91 – Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). 1975. 17p. INIS.
Production cross sections for ^{7}Be and ^{22}Na were measured by direct γ counting of targets of Si, Mg, Fe, and Ni irradiation with protons of 1, 2, 3, and 23 GeV. In essentially all cases significant differences are found with previously reported values. The results are also compared with a recent semi-empirical formula. (FR)

10713 (LYCEN-75-02, pp 1-4 (pt. S8)) TRANSITION PROBABILITIES OF ^{36}Cl AND ^{36}Ar EXCITED STATES IN HEAVY ION REACTIONS. Costa, G. J.; Alexander, T. K.; Forster, J. S.; McDonald, A. B.; Towner, I. S. [nd]. (In French).
From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).
In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69- Villeurbanne (France). Inst. de Physique Nucleaire).
The reactions ^{2}H(^{35}Cl, pγ) and ^{2}H(^{35}Cl, nγ) have been used to determine by the recoil-distance method, the lifetimes of levels in ^{36}Cl and ^{36}Ar respectively. Large discrepancies exist in the literature for some lifetimes of ^{36}Cl levels. Transition rates found for decay of the negative parity states in ^{36}Ar (4178 (3$^-$), 4974 (2$^-$) and 5171 (5$^-$) keV), are compared with the Maripuu-Hokken model and RPA and TDA predictions. (FR)

10714 ELECTROMAGNETIC AND ANGULAR MOMENTUM PROPERTIES OF STATES IN ^{25}Mg BELOW 6.05 MeV IN EXCITATION. Butler, P. A.; Brown, A. J.; Green, L. L.; James, A. N.; Lister, C. J.; MacArthur, J. D.; Nolan, P. J.; Sharpey-Schafter, J. F. (Univ. of Liverpool). J. Phys., G (London); 1: No. 6, 665-684(1 Aug 1975).
The reaction ^{22}Ne (α,n)^{25}Mg was used to populate levels in ^{25}Mg at α-particle energies of 8.00 and 9.15 MeV. Gamma rays from ^{25}Mg were detected in a Ge(Li)-NaI(Tl) escape-suppressed spectrometer and a three Ge(Li) Compton polarimeter. The analysis of angular distributions and linear polarizations gave unique spin and parity assignments of $\frac{1}{2}^-$, $\frac{9}{2}^+$, $\frac{1}{2}^-$, $\frac{13}{2}^+$, $\frac{11}{2}^+$, $\frac{9}{2}^+$ and $\frac{7}{2}^+$ to the levels at 4277, 4712, 5116, 5461, 5533, 5971 and 5977 keV and strongly favoured values of $\frac{11}{2}^-$ and $\frac{11}{2}^+$ for the levels at 5793 and 6041 keV respectively. Also, γ-ray multipole mixing ratios were accurately determined for many transitions from states below 6.05 MeV in excitation. The experimental measurements are discussed in terms of rotational model structure built on both single particle and 2 particle-1 hole excitations. The properties of the positive parity states are compared with predictions of existing shell model calculations, and are found to be well reproduced by a model calculation which used the full 2s-1d space and the interaction of Preedom and Wildenthal. (auth)

10715 CLUSTER ANALYSIS OF ^{20}Ne(α,2α) REACTIONS AT 78.6 MeV. Mithra, B.; Laverriere, R. (Univ. Claude Bernard, Lyon). Lett. Nuovo Cim.; 14: No. 1, 13-18(6 Sep 1975).
To obtain information on light nuclear structure, the shell model with the effective interaction between the nucleus components being analyzed by group symmetry considerations, mainly the SU(3) model, and cluster approaches were used to study (α,2α) reactions on neon-20 at 78.6 MeV in a coplanar and symmetrical geometry. Differential cross sections are plotted. It is concluded that the neon-20 nucleus is well represented by a cluster structure ^{16}O + α with a 30% probability. (JFP)

10716 DECAY OF THE T = 3/2 LEVEL AT 8.66 MeV IN ^{23}Na. Christiansson, J. E.; Dubois, J.; Jarneborn, L.; Odelius, H.; Roth, H. (Chalmers Tekniskn Hoegskola, Goteborg). Phys. Scr.; 10: No. 6, 297-300(Dec 1974).
The ^{22}Ne(d,nγ)^{23}Na reaction has been used to study the γ-ray deexcitation of $\frac{1}{2}^+$ levels in ^{23}Na. New branches were found for the T = $\frac{3}{2}$ level at 8.66 MeV. The experimental ΔT = 1, γ-ray transition strengths for this level cannot be explained by simple shell model theory but agree very well with those predicted by the collective model using Nilsson wavefunctions. (auth)

10717 ENERGY LEVELS OF ^{54}Mn. Weckstroem, I.; Fant, B.; Forsblom, L.; Viitasalo, M. (Univ., Helsinki). Phys. Scr.; 11: No. 1, 10-14(Jan 1975).
Two hundred and sixty-nine resonances of the ^{53}Cr(p,γ)^{54}Mn reaction in the proton range E_p = 1 180-2 100 keV have been observed. The γ-ray decay of 39 resonances was investigated by means of an 80 cm^3 Ge(Li) detector, and the energies and branching ratios of 55 bound states have been determined. The Q-value of the reaction was found to be 7 559.6 ± 1.0 keV. (auth)

10718 EXCITATION FUNCTIONS OF REACTIONS INDUCED IN NATURAL Mg, Al, AND Si BY ^{1}H AND ^{2}H IONS. Wilson, R. L. Laramie, WY; Univ. of Wyoming (1975). 74p. University Microfilms Order No. 75-22,343.
Thesis (Ph. D.).
Targets of natural Mg, Al and Si were irradiated with beams of ^{1}H and ^{2}H ions at the University of Colorado Cyclotron Facility. The energies employed ranged from 14.5 to 27 MeV for the ^{1}H beam and from 8.7 to 18 MeV for the ^{2}H beam. A pneumatic shuttle system was employed to move the target to a low background counting area where four sequential beta-delayed gamma-spectra were taken. The identities of product nuclei were established by measuring the energies and half lives of the beta-delayed gamma-rays which were emitted from the product nuclei. The amounts of the product nuclei which were created were determined by measuring the gamma-peak areas. Excitation functions were determined for 27 reactions. (Diss. Abstr. Int., B)

10719 TOTAL YIELD MEASUREMENTS IN ^{23}Na(p,gamma)^{24}Mg. Switkowski, Z. E.; O'Brien, R.; Smith, A. K.; Sargood, D. G. (Univ. of Melbourne). Aust. J. Phys.; 28: 141-153(1975).
The reaction ^{23}Na(p,gamma)^{24}Mg has been investigated in the proton energy range 0.25-2.5 MeV. Total gamma-ray strengths were determined for 64 resonances. A yield curve was measured over the range 0.65-2.55 MeV, and an estimate of the nonresonant cross section was obtained. Total resonance widths were deduced for 32 levels. (auth)

10720 EXPERIMENTAL EVIDENCE FOR THE VALIDITY OF DISCONTINUOUS STOPPING IN DSAM ANALYSIS. Kregar, M.; Kump, P.; Pavsic, M.; Ramsak, V.; Rupnik, P.; Vakselj, M. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). Nucl. Instrum. Methods; 127: No. 2, 243-248(1 Aug 1975).
Different methods used for the analysis of Doppler shifted gamma ray lines are compared via the determination of the lifetime of the 4.62 MeV (4$^+$) level in ^{28}Si. This level is excited using the ^{27}Al(p,γ) reaction with E_p = 767 keV and 1589 keV. The shape and shift of the gamma-ray due to the transition 4.62 MeV (4$^+$) → 1.78 MeV(2$^+$) in ^{28}S was measured. The best fit is obtained when discontinuous stopping for the recoiled ion is assumed. (NL)

10721 THE GIANT DIPOLE RESONANCE IN ^{26}Mg. Sugawara, M.; Terasawa, T.; Tamae, T. (Tohoku Univ., Sendai (Japan). Lab. of Nuclear Science); Kawamura, N.; Saito, H. (Tohoku Univ., Sendai (Japan). Dept. of Physics); Tsubota, H. (Tohoku Univ., Sendai (Japan). Coll. of General Education). Nucl. Phys., A; 248: No. 3, 477-484(1 Sep 1975).
The ^{26}Mg(e,e'p)^{25}Na and ^{26}Mg(e,e'α)^{22}Ne reactions have been studied over the region of excitation corresponding to the giant dipole resonance. The resulting cross section for photoproton emission has a distinct peak at 22 MeV excitation which constitutes the $T_>$ part of the resonance with a (2s1d)$^{-1}$(2p1f) configuration. The cross section for α-particle emission has no remarkable structure, which reflects the large spread of the $T_<$ part within the region of excitation from 19 to 28 MeV. (NL)

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Refer also to abstracts 10621, 10626, 10646, 10656–10658, 10696–10698, 10704, 10712, 10760, 10761, 10775, 10829, 10842, 10889, and 11002.

10722 (COO-535-733, pp 13-20) ENERGY DEPENDENCE OF THE NORMALIZATION FACTOR FOR THE ^{58}Ni(^{3}He,α)^{57}Ni REACTION. Shepard, J. R.; Zimmerman, W. R.; Kraushaar, J. J.; Kaczkowski, P. 1 Nov 1975.
In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10723 (COO-535-733, pp 49-53) PICKUP-STRIPPING CONTRIBUTION TO ^{3}He ELASTIC SCATTERING. Shepard, J. R.; Kunz, P. D.; Kraushaar, J. J. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10724 (COO-535-733, pp 55-60) MICROSCOPIC ANALYSIS OF ALPHA-NUCLEUS SCATTERING IN THE ENERGY RANGE FROM 20 TO 140 MeV. Ridley, B. W.; Chang, H. H. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10725 (COO-1265-170, pp 82-92) COLLECTIVE QUADRUPOLE TRANSITIONS IN A SHELL MODEL DESCRIPTION INCLUDING 1p1h EXCITATIONS. Morsch, H. P. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10726 (COO-1265-170, pp 169-177) (^{18}O,^{17}O) REACTION. Petersen, J. F.; Dehnhard, D. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10727 (COO-1265-170, pp 185-186) ELASTIC SCATTERING OF ^{18}O ON ^{28}Si, ^{40}Ca, ^{48}Ca, ^{54}Fe, AND ^{58}Ni. Artz, J. L.; Dehnhard, D.; Lewis, D. A.; Li, T. K.; Morsch, H. P.; Petersen, J. F.; Shkolnik, V.; Weber, D. J. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10728 (COO-1265-170, pp 187-198) INELASTIC ^{18}O SCATTERING. Lewis, D. A.; Morsch, H. P.; Petersen, J. F. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10729 (COO-1265-170, pp 199-202) TWO-NUCLEON TRANSFER WITH HEAVY IONS. Petersen, J. F.; Lewis, D. A.; Morsch, H. P.; Dehnhard, D.; Li, T. K.; Bayman, B. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10730 (CRN/PN-75-16) STUDY OF THE (^{3}He,d) REACTIONS ON ^{58}Ni, ^{60}Ni, AND ^{56}Fe NEAR THE COULOMB BARRIER. Baghdadi, A.; Seltz, R.; Magnac-Valette, D.; Bonneaud, G.; Gerardin, C. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Recherches Nucleaires). 1975. 20p. INIS.

Using spectroscopic information gained by earlier measurements of the proton bound states populated by stripping reactions (^{3}He,d), reactions on ^{58}Ni, ^{60}Ni, and ^{56}Fe targets are studied at energies near the Coulomb barrier and evaluation is made of the vertex function $\langle \phi\, dV_{pd}\, \phi^{3}He \rangle$. This value is then used to determine spectroscopic factors for low-lying states in ^{57}Co. (FR)

10731 (IN-2P3-CF-74-1, pp 1-15 (Pt.4B)) ELECTROMAGNETIC DE-EXCITATION OF T = 3/2 AND T = 2 STATES IN THE ^{41}Ca AND ^{36}Cl NUCLEI. Vernotte, J. [nd]. (In French).

From scientific meeting of the Tandem accelerators users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. Mont-Sainte-Odile, 15-17 May 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75 - Paris (France)).

Electromagnetic decay of these states was investigated. These states were populated by means of the ^{42}Ca(^{3}He,$\alpha\gamma$)^{41}Ca and ^{37}Cl(^{3}He,$\alpha\gamma$)^{36}Cl reactions, studied with a 18-MeV ^{3}He beam delivered by the Orsay MP Tandem. The electromagnetic decay of the first T = 3/2 state of ^{41}Ca was compared with the β^{+} decay of the ground state of ^{41}Ti. The electromagnetic decay of the first T = 2 state of ^{36}Cl is in correct agreement with a preliminary shell model calculation of B. H. Wildenthal. (FR)

10732 (INIS-mf-1544, pp 3-26) MEASUREMENT OF NEUTRON RADIATIVE CAPTURE CROSS SECTIONS FOR CHROMIUM, IRON, NICKEL, AND GOLD IN THE ENERGY RANGE 70 keV TO 550 keV. Rigoleur, S.; Arnaud, A.; Taste, J. 1974. (In French).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

In order to measure the absolute value of the radiation capture cross-sections of chromium, iron, nickel and gold in the energy region from 70 to 550 kev, use was made of a method of weighted amplitudes. In order to detect the cascade gamma radiation a liquid, hydrogenfree scintillator was used. The neutron flux was measured by a B-10 sodium iodide (Tl) detector having a known efficiency. A time-of-flight method was used with an on-line computer. (tr-auth)

10733 (INIS-mf-1544, pp 62-70) ELASTIC SCATTERING OF THE 14.7 MeV NEUTRONS BY THE IRON, COBALT, AND NICKEL SEPARATED ISOTOPES. Tutubalin, A. I.; Klyucharev, A. P.; Bozhko, V. P.; Golovnya, V. Ya.; Dolya, G. P.; Kachan, A. S.; Shlyakhov, N. A. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

By a time-of-flight method the differential cross-sections were measured for the elastic scattering of 14 MeV neutrons on the nuclei Fe-54, Fe-56, Co-59, Ni-58 and Ni-60. Corrections are introduced for angular resolutions, attenuation and multiple scattering in the sample by the Monte Carlo method. The experimental results are compared with calculations according to an optical model of the nucleus. (tr-auth)

10734 (INIS-mf-1544, pp 87-103) SOME FAST NEUTRON-NUCLEUS INVESTIGATIONS. Holmqvist, B. 1974.

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Experiments are discussed on investigating elastically and inelastically scattered neutrons, the spectra of prompt fission neutrons and (n,2nγ) reactions in the neutron physics section of the Swedish Committee on Atomic Energy in Studwick. (tr-auth)

10735 (INIS-mf-1544, pp 131-137) DIFFERENTIAL AND INTEGRAL CROSS SECTIONS OF THE (n,α) REACTIONS ON $^{50\ 52\ 53\ 54}$Cr NUCLEI AT 14.7 MeV NEUTRON ENERGY. Dolya, G. P.; Bozhko, V. P.; Golovnya, V. Ya.; Klyucharev, A. P.; Tutubalin, A. I. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Results of measurements of differential cross sections of (n,α) reactions, resulting from neutrons with 14.7-MeV energy on nuclei of ^{50}Cr, ^{52}Cr, ^{53}Cr, and ^{54}Cr are given. The measurements were made for angles of 0 to 150° at 25° intervals. (tr-auth)

10736 (INIS-mf-1544, pp 197-206) CROSS SECTIONS OF GAMMA RAYS PRODUCTION FROM THE ^{56}Fe(n,n'γ) REACTION FOR INCIDENT NEUTRONS IN THE ENERGY RANGE 4.8 TO 8.8 MeV. Lachkar, J.; Patin, Y.; Sigaud, J. (CEA, Paris). 1974. (In French).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The differential cross-section for emission of gamma radiation as a result of the ^{56}Fe(n,n'γ) reaction at energies from 4.8 to 8.8 MeV was measured. The results obtained are compared with published data and with results calculated on the basis of statistical theory of nuclear reactions. (tr-auth)

10737 (INIS-mf-1544, pp 216-226) CROSS SECTIONS OF GAMMA RAY PRODUCTION FOR MAGNESIUM, SILICON, CALCIUM, SCANDIUM, CHROMIUM, NICKEL, AND NATURAL IRON BY 14.1 MeV NEUTRONS. Grenier, G. (CEA, Paris). 1974. (In French).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Cross-sections of gamma emission for 14.1-MeV neutrons at angles of 90° and 55° relative to the neutron cone axis were made for silicon, chromium, and iron and at 90° only for magnesium, calcium, scandium, and nickel. For each gamma line the differential cross-section, probable reactions, and transitions are shown. Values obtained are compared with published results. (tr-auth)

10738 (INIS-mf-1698, pp 279-285) MEASUREMENTS OF NEUTRON CROSS SECTIONS BY A SCANNING METHOD. Stavisskii, Yu. Ya. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A look is taken at the possibility of direct energy calibration and determination of energy resolution on investigating energy dependencies of processes caused by neutrons with the use of a scanning method referenced to total cross-sections. (tr-auth)

10739 (JUL-Conf-16(Vol.1), pp 16) PARTICLE DECAY FROM THE GIANT RESONANCE REGION OF ^{40}Ca. Youngblood, D. H.; Bacher, A. D.; Bronson, J. D.; Moss, J. M.; Rozsa, C. (Texas A and M Univ., College Station). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10740 (JUL-Conf-16(Vol.1), pp 36) HIGH SPIN STATES IN pf-SHELL NUCLEI. Muether, H. (Inst. fuer Kernphysik, Juelich, Ger.); Goeke, K.; Faessler, A.; Allaart, K. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10741 (JUL-Conf-16(Vol. 1), pp 37) SELECTIVE POPULATION OF HIGH SPIN STATES IN ^{50}Cr. Savelli, C.; Morando, M.; Signorini, C. (Padua Univ.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10742 (JUL-Conf-16(Vol. 1), pp 38) HIGH-SPIN γ-RAY CASCADE IN ^{52}Mn. Stefanini, A.; Signorini, C.; Morando, M.; Ricci, R. A. (Padua Univ.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10743 (JUL-Conf-16(Vol. 1), pp 39) HIGH SPIN STATES IN THE f-p SHELL: Ni ISOTOPES. Delaunay, J. (CEN, Saclay, France). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10744 CROSS-SECTIONS OF (n,2n) REACTIONS FOR ^{46}Ti, ^{66}Zn, ^{115}In, AND ^{197}Au. Paulsen, A.; Liskien, H.; Widera, R. (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Atomkernenergie; 26: No. 1, 34-36(1975).

4 figs.; 3 tabs.; 42 refs.

Excitation functions have been determined in the 10 to 20 MeV energy region for the reactions ^{46}Ti(n,2n)^{45}Ti, ^{66}Zn(n,2n)^{65}Zn, ^{115}In(n,2n)^{114m}In (49.2 d) and ^{197}Au(n,2n)^{196}Au by means of the activation technique. There is considerable scatter among existing data for these reactions in the 13 to 15 MeV energy region. Evidence is discussed that these discrepancies are due to deviating assumptions for the decay schemes and insufficient energy resolution of activity detectors in the past. For the reactions In 115(n,2n)In 114m and Au 197(n,2n)Au 196 the present results are confirming the lowest cross-sections from the existing data. (auth)

10745 LIFETIME OF THE 3464-keV LEVEL IN ^{40}Ar. Poletti, A.R.; Radford, D.C.; Southon, J.R. (Department of Physics, University of Auckland, Auckland, New Zealand). Phys. Rev. C 12: No. 5, 1407-1409 (Nov 1975).

Direct electronic timing has been used to measure the mean life of the 3464-keV state in ^{40}Ar. The state was populated by the ^{37}Cl(α, p)^{40}Ar reaction at 10.6 MeV, and the mean life was determined to be 1.00±0.03 nsec. The measured lifetime in conjunction with other γ-ray angular distributions and previous ^{38}Ar(t, p)^{40}Ar results allows an assignment of $J^\pi = 6^+$ to the level. The $E2$ transition strengths of the ^{40}Ar $6^+ \rightarrow 4^+$, $4^+ \rightarrow 2^+$, and $2^+ \rightarrow 0^+$ transitions are compared to those in ^{42}Ca and to a weak-coupling calculation. (auth)

10746 $(f_{7/2})^2_{7,0}\, d_{3/2}{}^{-1}$ CONFIGURATION STATES IN ^{41}Ca STRONGLY POPULATED BY THE ^{39}K(α, d) REACTION. Nann, H.; Chien, W.S.; Saha, A.; Wildenthal, B.H. (Cyclotron Laboratory and Department of Physics, Michigan State University, East Lansing, Michigan 48824). Phys. Rev. C 12: No. 5, 1524-1528 (Nov 1975).

Angular distributions of levels in ^{41}Ca strongly populated in the ^{39}K(α, d) reaction have been measured at $E_\alpha = 40$ MeV. Levels which have components corresponding to the coupling of the captured proton-neutron pair in the $(f_{7/2})^2_{7,0}$ configuration to the ground state of ^{39}K have been identified by means of their characteristic $L = 6$ angular distributions. Evidence for the $[(f_{7/2})^2_{7,0}\, d_{3/2}{}^{-1}]$ 2p-1h character of the states in ^{41}Ca at 3.37, 3.83, 3.92, 3.97, 4.52, 5.22, and 5.35 MeV is discussed. (auth)

10747 LIFETIMES OF THE 2893- AND 3464-keV LEVELS OF ^{40}Ar. Warburton, E.K.; Olness, J.W.; Kolata, J.J. (Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. C 12: No. 5, 1392-1395 (Nov 1975).

The recoil-distance method has been used in conjunction with the ^{27}Al(^{18}O, $p\alpha$)^{40}Ar and ^{37}Cl(α, p)^{40}Ar reactions to measure mean lifetimes of 4.2±2.0 and 930±50 ps for the ^{40}Ar 2893- and 3464-keV levels, respectively. The excitation energies of these two levels were deduced to be 2892.60±0.11 and 3464.48±0.13 keV, respectively. The 3464-keV level is assigned $J^\pi = 6^+$ on the basis of the lifetime, the γ-ray angular distribution, and previous ^{38}Ar(t, p)^{40}Ar results. The $E2$ transition strengths of the ^{40}Ar 0^+-2^+-4^+-6^+ ground-state band are compared to those of ^{42}Ca and to shell-model calculations. (auth)

10748 NUCLEAR REACTIONS IN THE CONTINUUM: (A) COMPOUND NUCLEAR CONTRIBUTIONS TO (p,p') REACTIONS, (B) ANGULAR-CORRELATION IN THE (p,n anti p) REACTION. Rao, G. R. Pittsburgh: Univ. of Pittsburgh (1974). 150p. University Microfilms Order No. 75-21,763.

Thesis (Ph. D.).

Two different reactions are considered in this work, viz., (p,p') and (p,n anti p) reactions. A clean separation is made between the compound nuclear and direct reaction contributions to the low energy continuum region of the energy spectra of protons from inelastic scattering. Bombarding energies used are 12 MeV and 17 MeV, and target nuclei are the isotopes of Ni, Zr, Mo, Cd, and Sn. The spectra from the heavier isotopes are identified as entirely due to direct reactions. The excess cross sections obtained in the light isotopes are identified as compound nuclear contributions. This contribution is studied by comparison with statistical theory calculations. The level density parameters and the proton emission probabilities are determined from the data. Isospin effects are also considered. The experimental results are in good agreement with the predictions of statistical theory. Calculations are presented here for the angular correlation between the neutron and proton in the (p,n anti p) reaction where the (p,n) reaction excites the isobaric analogue state (IAS) of the target ground state, which then decays by proton emission. The (p,n) reaction is treated as a charge-exchange direct reaction and calculations are done in the plane wave Born approximation. The angular correlation function is calculated for ^{91}Zr, ^{95}Mo, ^{93}Nb, and ^{99}Tc. The alignment of the IAS in terms of the populations of the magnetic substates are also presented here for ^{43}Ca, ^{47}Ca, and ^{51}V. The theoretical results for ^{91}Zr and ^{95}Mo are compared with experimentally measured coincidence angular distributions of the outgoing protons. Both suggest isotropic angular distributions for ^{91}Zr and ^{95}Mo. (Diss. Abstr. Int., B)

10749 ROLE OF CONSISTENCY EFFECTS ON THE ANTI-SHIELDING OF NUCLEAR QUADRUPOLE MOMENTS: COMPARISON BETWEEN DIAGRAMMATIC AND DIFFERENTIAL-EQUATION APPROACHES FOR THE FERRIC ION. Ray, S. N. (State Univ. of New York, Albany); Lee, T.; Das, T. P.; Sternheimer, R. M.; Gupta, R. P.; Sen, S. K. Phys. Rev., A; 11: No. 6, 1804-1809(Jun 1975).

A detailed comparison is carried out between consistency contributions to the nuclear quadrupole antishielding factor for the Fe^{+3} ion obtained by the linked-cluster many-body perturbation procedure, as well as a procedure employing perturbed wave functions used in conventional differential-equation procedures for studying antishielding factors. The agreement between results by the two procedures is found to be good, indicating that the procedure using perturbed wave functions is a viable one for studying consistency effects, at least for positive ions. 3 tables. (auth)

10750 THERMAL AND LOW-ENERGY NEUTRON CAPTURE GAMMA-RAY AND CONVERSION-ELECTRON SPECTROSCOPY IN VIBRATION-LIKE NUCLEI. Seyfarth, H. (Institut fuer Kernphysik, Juelich, Ger.). pp 166-180 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

In contrast to the deformed nuclei which are rather well described by the advanced rotational models most of the vibrational or vibration-like nuclei are far from being understood, even if they are near to closed shells. To test the reliability of theoretical predictions, it is necessary to get complete data using all possible ways of excitation and all feasible experimental techniques. What can be contributed to the understanding of vibration-like nuclei by means of neutron-capture reaction studies is discussed. The emphasis is put on the question which data can be obtained complementary to those obtained from the radioactive decay or heavy-ion and particle-induced reactions. The first part contains a survey of the present techniques used in (n,gamma) and (n,e$^-$) studied, demonstrated by characteristic examples. In the second part the recent data for a few specific nuclei of interest are discussed and compared to the results of model calculations. Some suggestions are made for the further work from both the experimental and theoretical point of view. 2 tables, 7 figures. (auth)

10751 THE YIELD OF Ti, V, Cr, Fe, Ni, Cu AND Zn THROUGH ACTIVATION BY PROTONS OF ENERGIES LIMITED TO 20 MeV. Barrandon, J. N.; Debrun, J. L.; Kohn, A.; Spear, R. H. (Groupe d'Application des Reactions Nucleares a l'Analyse Chimique, Centre National de la Recherche Scientifique, Service du CYCLOTRON, 45045 Orleans Cedex, France.). Nucl. Instrum. Methods; 127: No. 2, 269-278(1 Aug 1975). (In French).

Activation curves and yields for the main radioisotopes obtained by irradiation of Ti, V, Cr, Fe, Ni, Cu and Zn with protons were studied between 0 and 20 MeV. With the help of these data, it was possible to study and to achieve the analysis of these 7 elements in several matrices by means of the radioisotopes ^{48}V, ^{51}Cr, ^{52m}Mn, ^{53}Mn, ^{55}Co, ^{56}Co, ^{57}Ni, ^{60}Cu, ^{61}Cu, ^{63}Zn, ^{65}Zn, ^{66}Ga, ^{67}Ga, ^{68}Ga. (NL)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 10621, 10646, 10656, 10687, 10698, 10730, 10732–10734, 10738, 10743, 10744, 10751, 10827, 10835, 10843, and 11019.

10752 (COO-535-733, pp 20-24) LEVEL STRUCTURE OF ^{78}Br. Kluger, B. M.; Anderson, R. E.; Peterson, R. J.; Ristinen, R. A. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10753 (COO-535-733, pp 25-28) SEARCH FOR TWO-STEP PROCESS IN THE Ni(p,t) REACTIONS. Schneider, M. J.; Burch, J. D.; Kunz, P. D. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10754 (COO-535-733, pp 33-35) ^{64}Ni(α,^{6}He)^{62}Ni REACTION. Shepard, J. R.; Cecil, F. E.; Anderson, R. E. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10755 (COO-535-733, pp 46-48) STUDY OF THE ^{60}Ni(^{3}He,t) ^{60}Cu REACTION. Schneider, M. J.; Rudolph, H.; Zimmerman, W. R. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10756 (COO-535-733, pp 72-73) STUDY OF THE ^{89}Y(p,n) REACTION TO THE ANTI-ANALOG AND ANALOG STATES OF ^{89}Zr. Wieman, H. H.; Anderson, R. E.; Cecil, F. E.; Lind, D. A.; Leth, S.; Zafiratos, C. D. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10757 (CRN/PN-75-17) MEASUREMENTS OF SPECTROSCOPIC FACTORS IN ^{61}Ni BY THE (d,p) REACTION BELOW THE COULOMB BARRIER. Baghdadi, A.; Seltz, R.; Magnac-Valette, D.; Bonneaud, G.; Gerardin, C. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Recherches Nucleaires). 1975. 13p. (In French). Dep. NTIS (US Sales Only) $4.50.

Spectroscopic factors for the two most strongly excited l = 0 and l = 2 states in ^{61}Ni have been measured by the (d,p) reaction in subcoulombic conditions. The results confirm a close to 50% missing strength for the filling of the 3s$_{\frac{1}{2}}$ and 2d orbitals in ^{61}Ni. (2 figures, 3 tables) (auth)

10758 (FRNC-TH-517) NUCLEAR SPECTROSCOPY BY RADIOACTIVITY. Study of Nuclei Adjacent to the 82 Neutron Closed Shell and Application to Fission. Carraz, L. C. (Grenoble-1 Univ., 38 (France)). 1974. 109p. (In French). INIS.

Chemical separation techniques have been developed which make it possible to obtain a certain number of isotopes presenting anomalies in the fission efficiencies (near the magic shell N = 82). A short description is given of the fission phenomenon by analyzing the selection of isotopes investigated; it is shown how it was possible to explain the results by means of computers and the various chemical separations perfected are described. Thus a study was made of the ^{144}La direct γ spectrum. It was shown that the anomalies in the fission efficiencies of certain nuclei are apparent only. Hence, it is the presence of isomers and the distribution of the corresponding efficiency between two isomers which are the cause of the apparent weakness of the efficiency of ^{134}I, ^{136}I, and ^{136}Cs, and of certain isotopes of Nb(Z = 41). The nuclear spectrometry of nuclei of the area N = 82 has made it possible to extend the existence of a metastable state to ^{136}Xe and ^{138}Ba. The value of the energies of the first 2^+, 4^+, 6^+ levels and the half life duration of the 6^+ metastable state are given. The discussion of the results and of the models show that the interpretation of the 0^+, 2^+, 4^+ of the 82 neutron nuclei by means of a two quasi-particle (protons) model gives a fairly satisfactory description of the various experimental events: elastic scattering, γ spectrometry and proton transfer reactions; on the other hand the interpretation of higher energy levels requires the use of more complicated configurations. (FR)

10759 (IN-2P3-CF-74-1, pp 1-39 (Pt.2A)) PROBLEMS CONCERNING THE OPTICAL POTENTIAL AND CORE EXCITATION IN TRANSFER REACTIONS INDUCED BY HEAVY IONS. Sztark, H. [nd]. (In French).

From scientific meeting of the Tandem accelerators users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. Mont-Sainte-Odile, 15–17 May 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

The comparison between ^{64}Ni(^{16}O,^{14}C)^{66}Zn and ^{64}Ni(^{12}C,^{10}Be)^{66}Zn two proton transfer reactions allows the correlation between the transferred nucleons to be tested. The large difference observed between angular distributions for two neighboring nuclei in selenium isotopes populated by two proton transfer reactions on ^{76}Ge and ^{74}Ge suggests a two-step mechanism including a core excitation of the target and and/or the residual nucleus ^{65}Cu populated by the proton transfer reactions ^{64}Ni(^{16}O,^{15}N)^{65}Cu and 56-MeV and ^{64}Ni(^{12}C,^{11}B)^{65}Cu at 48-Mev were also studied. (FR)

10760 (INIS-mf-1544, pp 56-61) SCATTERING OF THE 2.9 MeV NEUTRONS BY IRON, CHROMIUM, AND ZINC EVEN-EVEN ISOTOPES. Fedorov, M. B.; Yakovenko, T. I. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

By a time-of-flight method measurement was made of angular distributions of elastic and inelastic (with excitation of the first 2^+ levels) scattering of 2.9 MeV neutrons on the isotopes Fe-56, Cr-50, Cr-54, Zn-64 and Zn-66. An analysis of the data is presented according to an optical model and the statistical theory of Hauser–Feshbach. (tr-auth)

10761 (INIS-mf-1544, pp 75-77) COMPILATION OF FAST NEUTRON CROSS SECTIONS. Body, Z. T.; Csikai, J. (Kossuth Lajos Tudomanyegyetem, Debrecen, Hungary). 1974.

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A brief review is given of studies on the compilation of cross-sections for fast neutrons, which were carried out in the last 2 to 3 years at the Institute of Experimental Physics. (Debretsen). (tr-auth)

10762 (INIS-mf-1544, pp 138-144) STUDY OF THE Zn^{68} (n,γ)Zn^{69gm} REACTION. Dovbenko, A. G.; Zaikin, G. G.; Ignatyuk, A. V.; Korzh, I. A.; Sklyar, N. T.; Tolstikov, V. A. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

An activation method was used to obtain the radiation capture cross-section of neutrons by the ^{68}Zn nucleus and the ratio of probability of formation of isomer pairs as a result of the ^{68}Zn $(n,\gamma)^{69g,m}$Zn reaction in the energy range 200-2500 keV. The energy path of neutron capture cross-section was determined relative to the fission cross-section of ^{235}U with fast neutrons. For normalizing, the cross-section of the ^{68}Zn$(n,\gamma)^{69g}$Zn reaction with thermal neutrons and the fission cross-section of ^{235}U with thermal neutrons were used. (tr-auth)

10763 (INIS-mf-1544, pp 243-249) STUDY OF PRIMARY LEVELS OF ^{90}Zr FOLLOWING THE ^{89}Y(d,n)^{90}Zr REACTION INDUCED BY 11.5 MeV DEUTERONS. Adam, A.; Adam, D. (CEA, Paris). 1974. (In French).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A brief description is given of the neutron time-of-flight spectrometer of the Bruer-le-Chatelle research center and of its use for studying angular dispersion of neutrons of the ^{89}Y(d,n)^{90}Zr reaction. Spectroscopic data obtained are compared with known experimental results and theoretical calculations. (tr-auth)

10764 (JUL-Conf-16(Vol. 1), pp 18) GIANT RESONANCE EFFECTS IN ^{58}Ni(pp')1^{+}, 3^{+} EXCITATIONS. Amos, K.; Smith, R. (Univ. of Melbourne, Victoria, Australia). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10765 (JUL-Conf-16(Vol. 1), pp 40) IN BEAM GAMMA SPECTROSCOPY OF ZINC ISOTOPES BY COMPOUND REACTIONS USING ALPHA AND HEAVY IONS BEAMS. Bruandet, J. F.; Agard, M.; Giorni, A.; Glasser, F.; Longequeue, J. P. Tsan Ung Chan. (Institut des Sciences Nucleaires, Grenoble, France). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10766 (JUL-Conf-16(Vol. 1), pp 41) LEVEL STRUCTURE OF ^{69}Ge AND ^{71}Ge. Eberth, U.; Eberth, J. (Univ., Cologne). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10767 (JUL-Conf-16(Vol. 1), pp 42) SELF-CONSISTENT 2-QUASIPARTICLE CORE COUPLING MODEL FOR DEFORMED NUCLEI. Didong, M.; Muether, H.; Goeke, K.; Faessler, A. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10768 (JUL-Conf-16(Vol. 1), pp 43) LIFETIME MEASUREMENTS IN g 9/2 DECOUPLED BANDS. Heits, B.; Friedericks, H. G.; Gelberg, A.; Lieb, K. P.; Peregro, A.; Rascher, R.; Zell, K. O.; von Brentano, P. (Univ., Cologne). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10769 (JUL-Conf-16(Vol. 1), pp 44) ROTATIONAL BANDS IN ^{73}Se AND ^{77}Se. Zell, K. O.; Friedericks, H. G.; Gast, W.; Heits, B.; von Brentano, P. (Univ., Cologne). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst fuer Kernphysik).

10770 (JUL-Conf-16(Vol. 1), pp 82) HIGHLY EXCITED STATES AND PRECOMPOUND EMISSION IN ^{67}Ga AND ^{72}Se NUCLEI OBTAINED BY ^{16}O AND ^{12}C INCIDENT CHANNELS. Chevarier, A. (Univ., Lyon, France); Chevarier, N.; Chiodelli, S.; Demeyer, A.; De Saintignon, P.; Martin, P. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10771 (LYCEN-75-02, pp 1-14 (Pt.S3)) STUDY OF THE ONE- AND TWO-PROTON TRANSFER REACTION MECHANISM INDUCED BY ^{16}O AND ^{12}C. Cobern, M.; Lemaire, M. C.; Mermaz, M. C.; Sztark, H. [nd]. (In French).

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10–15 February 1975. (Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire).

One and two proton transfer reactions induced by 56-MeV ^{16}O beam were studied on a ^{64}Ni target simultaneously with the ^{64}Ni(^{16}O,^{16}O)^{64}Ni elastic and inelastic scattering. The ^{64}Ni(^{16}O, ^{14}C)^{66}Zr angular distributions exhibit oscillations at forward angle due to a strong localization of this reaction at the nuclear surface. The strong sensitivity of the two nucleon transfer to the optical model parameters was used to determine the optical potential of the ^{64}Ni + ^{16}O interaction. It turned out that this potential has to be surface transparent. The (^{16}O,^{14}C) two proton stripping was also studied on ^{72}Ge, ^{74}Ge, ^{76}Se and ^{78}Se residual nuclei, the ground-state and 3^{-} level have bell shapes, while the one phonon 2^{+} and the two phonon triplet oscillate at forward angles, all levels in ^{74}Se have bell shaped angular distributions. Such a drastic change in shape was reproduced with coupled channel calculations including coupling in both the entrance and exit channels. (FR)

10772 STATISTICAL THEORY OF NUCLEAR CROSS SECTION FLUCTUATIONS. Richert, J. (Centre National de la Recherche Scientifique, 67-Strasbourg (France). Centre de Recherches Nucleaires); Simbel, M. H.; Weidenmueller, H. A. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Z. Phys., A.; 273: No. 2, 195-203(Jun 1975).

3 figs.; 2 tabs.; 28 refs.

We present formulas for the auto- and cross-correlation functions of various observables, taking into account direct reactions. These formulas are valid in the limit of strong absorption and are deduced from the statistics of the nuclear matrix elements. We thereby put fluctuations theory on a new basis, and extend its domain of validity by including direct reactions. We obtain an explicit expression for the correlation length. Numerical calculations show that our formulas apply only in the strong-absorption limit, and that significant deviations occur for medium or weak absorption. We apply our results to the calculation of the cross-correlation function for the cross sections for elastic and inelastic proton scattering on ^{88}Sr through the $\frac{1}{2}^{+}$ isobaric analogue resonance. (auth)

10773 INVESTIGATION OF ^{64}Zn BY ^{65}Ga DECAY. Chang, B. H.; Huang, S. L.; Hsu, W. S.; Liu, Y. C. (National Tsing Hua Univ., Hsinchu, Taiwan). Chin. J. Phys. (Taiwan); 13: No. 1, 19-25(Apr 1975).

The decay of 15.2 min ^{65}Ga to levels of ^{65}Zn was studied with a 40-cm^{3} Ge(Li) detector and with Ge(Li)–NaI(Tl) coincidence measurements. About forty-five γ rays were observed. Data from singles and coincidence measurements were incorporated into a decay scheme. (5 figures, 2 tables) (auth)

10774 ROLE OF SENIORITY NUMBER IN SHELL-MODEL CALCULATIONS. Wang, M. C.; Chiang, H. C.; Hsieh, S. T.; Lin, E. K. (Tsing Hua Univ., Hsinchu, Taiwan). Chin. J. Phys. (Taiwan); 13: No. 1, 55-58(Apr 1975).

The shell-model calculations for copper isotopes are carried out with seniority number restriction. The role of seniority number is discussed. The calculations show that the low-seniority number restriction is an effective way to reduce the size of model space. (3 figures) (auth)

10775 EFFECTIVE-INTERACTION CALCULATION OF THE ENERGY SPECTRA OF COPPER ISOTOPES. Wang, M. C.; Chiang, H. C.; Hsieh, S. T. (National Tsing Hua Univ., Hsinchu, Taiwan). Nuovo Cim., A; 29A: No. 1, 49-63(1 Sep 1975).

Eleven energy spectra of copper isotopes from ^{58}Cu to ^{68}Cu are studied in the conventional shell model. The model space is restricted to the low seniority configurations. Some T = 0 two-body interactions are determined by a least-squares fit between the calculated and experimental low lying energy levels. Good agreement is obtained with the observed level structure. Single-nucleon spectroscopic factors of ^{64,66}-Cu are calculated and compared with experiments. The results show that the low seniority

restriction is an effective way to reduce the dimensionality of the model space for medium nuclei. (auth)

10776 ABSOLUTE CROSS SECTIONS FOR THE $^{63,65}Cu(^{16}O, X)$ REACTIONS. Wells, J.C. Jr. (Tennessee Technological University, Cookeville, Tennessee 38501); Robinson, R.L.; Kim, H.J.; Ford, J.L.C. Jr. Phys. Rev. C 12: No. 5, 1529-1539 (Nov 1975).

The absolute cross sections for a number of different reactions resulting from the bombardment of $^{63,65}Cu$ with 38.5-, 41.0-, 43.5-, 46.0-, 48.5-, and 51.0-MeV ^{16}O ions were determined from γ-ray yields observed from the decay of resulting radioactivities, and from yields of in-beam γ rays. The total cross section was compared to an optical model calculation and to a parabolic barrier potential calculation. The relative population of the reaction products was compared to calculations for the statistical decay of a compound nucleus by n, p, and α evaporation. This model does account for the general features of the experimental results, and agrees reasonably well with the stronger exit channels. A summary of the general features of the $^{58,60,61}Ni(^{16}O, X)$ and $^{63,65}Cu(^{16}O, X)$ reactions is included. (auth)

10777 PARTICLE-EMISSION CROSS SECTIONS FOR PION BOMBARDMENT OF Mg, Ni, AND Ag AT 235 MeV. Amann, J.F.; Barnes, P.D.; Doss, M.; Dytman, S.A.; Eisenstein, R.A.; Penkrot, J.; Thompson, A.C. (Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213). Phys. Rev. Lett. 35: No. 16, 1066-1069 (20 Oct 1975).

A study of the inclusive reaction $\pi^+ + A \rightarrow X +$ anything has been analyzed for 235-MeV pions and Mg, Ni, and Ag targets with $X = p$, d, t, ^3He, and ^4He in the energy range 15–400 MeV. The cross section for proton emission is found to be as much as a factor of 8 less than that predicted by intranuclear-cascade calculations. The complex-particle-emission cross sections are found to be consistent with a nucleon-pickup mechanism. (auth)

10778 COMMENT ON THE EXISTENCE OF A LOWER ANGULAR MOMENTUM CUTOFF IN THE FUSION OF HEAVY IONS. Natowitz, J.B.; Namboodiri, M.N. (Cyclotron Institute and Department of Chemistry, Texas A&M University, College Station, Texas 77843). Phys. Rev. C 12: No. 5, 1678-1679 (Nov 1975).

Gauvin *et al.* have suggested that one possible explanation for the high thresholds of the reactions $^{74}Ge(^{84}Kr, xn)^{158-x}Er$ is the existence of a lower limit to the angular momentum of the compound system formed in the fusion step. We note that such lower limits have, in fact, previously been observed in the collisions of water droplets. Investigation of such lower limits may provide interesting new information on nuclear properties. (auth)

10779 PROTON STATES IN ^{87}Rb. Medsker, L.R.; Fortune, H.T.; Headley, S.C.; Bishop, J.N. (Physics Department, University of Pennsylvania, Philadelphia, Pennsylvania 19174). Phys. Rev. C 12: No. 5, 1516-1523 (Nov 1975).

The $^{86}Kr(^3He, d)^{87}Rb$ reaction has been studied at a bombarding energy of 18 MeV. The isotopically enriched ^{86}Kr target was contained in a gas cell with no entrance window. Excitation energies and angular distributions were obtained for 60 levels below 7 MeV in ^{87}Rb. A distorted-wave analysis was used to determine l values and spectroscopic strengths. The results are compared with previous data from transfer reactions and radioactive decay. (auth)

10780 PROTON STATES IN ^{85}Y. Medsker, L.R.; Florey, G.S.; Fortune, H.T. (Physics Department, University of Pennsylvania, Philadelphia, Pennsylvania 19174); Wieland, R.M. Phys. Rev. C 12: No. 5, 1452-1456 (Nov 1975).

The $^{84}Sr(^3He,d)^{85}Y$ reaction has been studied at a bombarding energy of 18 MeV to extend the systematics of proton states in the odd-A yttrium nuclei. Thirty-seven states in the previously uninvestigated $^{85}_{39}Y_{46}$ were observed. A distorted-wave analysis was used to determine l values and spectroscopic strengths. The ground state of ^{85}Y is assigned $J^\pi = 1/2^-$ and the first excited state (at 20 keV) $9/2^+$. The results are compared with previous $(^3He,d)$ reaction studies on ^{86}Sr and ^{88}Sr. (auth)

10781 NUCLEAR DATA SHEETS FOR A equals 183. Artna-Cohen, A. (Oak Ridge National Lab., TN). Nucl. Data Sheets; 16: No. 2, 267-316(Oct 1975).

The available experimental data pertaining to the nuclei with A equals 183 are compiled. The data from various decay and reaction experiments have been evaluated, compared, and combined to present an adopted level scheme for each nucleus. Arguments for spin, parity, and Nilsson level assignments are given. In addition, there are comments about the adopted level schemes and about discrepancies and deficiencies in the existing information. (auth)

10782 DECOUPLED BANDS IN MEDIUM MASS NUCLEI. von Brentano, P. (Univ., Cologne); Heits, B.; Protop, C. pp 154-165 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

Experimental verification of the existence of Coriolis decoupled (stretched) bands in medium weight nuclei is discussed using examples from (alpha,xn gamma) and (^{16}O,^{18}O, xn gamma) reactions and in-beam gamma spectroscopy. These measurements usually allow spin assignments for high spin states with a large degree of confidence. It is seen that the number of stretched high spin bands in medium mass transitional nuclei correlates well with the ground band in even neighboring nuclei. This parallelism seems to be a rather general phenomenon for high spin states in transitional nuclei. 2 tables, 11 figures. (SDF)

10783 ENERGY DEPENDENCE OF ISOSPIN MIXING IN THE DECAY OF ^{64}Zn. Lux, C. R.; Porile, N. T. (Purdue Univ., Lafayette, Ind. (USA). Dept. of Chemistry). Nucl. Phys., A; 248: No. 3, 441-450(1 Sep 1975).

The ^{64}Zn compound nucleus was formed at energies of 17.6–23.5 MeV in the reactions $^{63}Cu + p$ and $^{60}Ni + \alpha$ and energy spectra of the emitted protons and α-particles were recorded. The extent of isospin mixing between the $T_>$ and $T_<$ states of the compound nucleus was determined by comparison of the quantity $\sigma(p,p')\sigma(\alpha,\alpha')/\sigma(p,\alpha)\sigma(\alpha,p)$ with theory. The mixing fraction decreases from 0.8 to 0.4 over the above energy interval. The mixing matrix element shows a corresponding decrease from 0.34 to 0.07 keV. (NL)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 10438, 10705, 10734, 10738, 10744, 10748, 10761, 10763, 10771, 10777, 10782, 10852, 10863, 10873, 10875, 10887, 10889, 11003, 11036, 11038, 11040, and 11043.

10784 (CNAEM-R-142) GAMMA-RAY SPECTRUM FROM RADIATIVE CAPTURE OF THE FIRST RESONANCE NEUTRONS IN ^{149}Sm. Cansoy, C.; Atasoy, H.; Ozbayli, C. (Cekmece Nuclear Research and Training Center, Istanbul (Turkey)). 1975. 22p. Dep. NTIS (US Sales Only) $4.50.

A 37-cc lithium-drifted germanium detector has been used in conjunction with the CNAEM neutron crystal spectrometer to examine the gamma-ray spectrum arising from neutron resonance capture in ^{149}Sm. The effective gamma-ray energy resolution of 0.6 to 2.4 keV allowed 17 transitions to be examined in the energy range between 109 and 1806 keV following the capture of 0.0976 eV resonance neutrons in ^{149}Sm. The spectrum is interpreted in terms of the levels in the compound nucleus, ^{150}Sm. An analysis of the reduced intensities of 38 E1 transitions which consist of 9 secondary and 29 primary transitions indicates that they have a cumulative Porter-Thomas distribution. A similar analysis has been applied to 15 M1 transitions which consist of 4 secondary and 11 primary transitions. (6 tables, 5 figures) (auth)

10785 (COO-535-733, pp 10-13) ODD-ODD NUCLEI IN THE MASS 100 REGION: ^{102}Rh. Anderson, R. E.; Kraushaar, J. J.; Kluger, B. M. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10786 (COO-535-733, pp 76-81) $(^3He,n)$ REACTION NEAR Z = 50. Fielding, H. W.; Anderson, R. E.; Zafiratos, C. D.; Lind, D. A.; Alford, W. P.; Cecil, F. E.; Weiman, H. H.; Leth, S. C. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10787 (COO-1265-170, pp 96-102) MEASUREMENT OF THE $^{119}Sn(p,n)^{119}Sb$ REACTION TO THE GROUND STATE ISOBARIC ANALOG AND EVIDENCE FOR EXCITED ANALOGS. Poppe, C. H.; Grimes, S. M.; Wong, C. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10788 (COO-1265-170, pp 103-110) COMPARISON OF THE FORMATION AND DECAY OF THE g.s. ANALOG STUDIES OF ^{119}Sn. Fitzgerald, D. H.; Lilley, J. S.; Poppe, C. H. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10789 (COO-1265-170, pp 111-114) $^{91}Zr(p,np\sim)^{90}Zr$ AND $^{95}Mo(p,np\sim)^{94}Mo$ REACTIONS. Fitzgerald, D. H.; Lilley, J. S.; Poppe, C. H. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10790 (INIS-mf-1544, pp 78-81) NEUTRON RADIATIVE CAPTURE CROSS SECTION AT THE 14.7 MeV ENERGY. Peto, G.; Csikai, J. (Kossuth Lajos Tudomanyegyetem, Debrecen, Hungary). 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The cross-section of the Rh-103(n,γ) reaction at neutron energies of 14.7 MeV depends strongly on the experimental irradiation conditions. At the same time these same cross-sections for various isotopes obtained in various laboratories are in good agreement. (tr-auth)

10791 (INIS-mf-1544, pp 82-84) MEASURING Rh^{103}(n,n') Rh^{103m} CROSS SECTIONS AT NEUTRON ENERGY 14.8 AND 2.7 MeV AND Pu-Be AND Cf^{252} SOURCES. Pazhit, A. (Kossuth Lajos Tudomanyegyetem, Debrecen, Hungary); Peto, G.; Ezha, L.; Csicai, J.; Basco, J. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The cross-section was measured for the reaction Rh-103 (n,n')Rh-103m at neutron energies of 14.8 and 2.7 MeV and with neutrons from Pu-Be and Cf-252 sources. The cross-section was determined by an activation method by means of the reaction In-115(n,n')In-115m. (tr-auth)

10792 (INIS-mf-1544, pp 108-114) NUCLEAR DEFORMATION EFFECT ON TOTAL CROSS SECTIONS. Dyumin, A. N.; Egorov, A. I.; Popova, G. N.; Smolin, V. A. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Measurements were made of the total neutron cross-sections of the isotopes of neodymium, samarium and gadolinium at E_n = 14.2 MeV. A study was made of the effect of nuclear deformation on the magnitude of the total cross-section. A dependence of the increase in total cross-section as a function of the deformation parameter β_2 was established. (tr-auth)

10793 (INIS-mf-1544, pp 115-119) MEASUREMENT OF GAMMA-RADIATION PRODUCTION TOTAL CROSS SECTIONS IN THE (n,xn'γ) REACTION. Savin, M. V.; Paramonova, I. N.; Chirkin, V. A.; Khokhlov, Yu. A.; Kuryakin, V. F. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A method for measuring the energy dependence of the total formation cross-section of gamma radiation upon inelastic interaction of 0.5- to 10-MeV neutrons in a linear electron accelerator using the time-of-flight method with a resolution of 1 nsec/min is described. The gamma energy in the range 0.5 to 5 MeV is recorded in a hydrogen-free liquid scintillator. (tr-auth)

10794 (INIS-mf-1544, pp 207-215) EXPERIMENTAL METHODS, DATA ACQUISITION, AND PROCESSING FOR THE (n,xγ) REACTION. Grenier, G.; Gautier, M.; Poussier, G. (CEA, Paris). 1974. (In French).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

10795 (IPNO-T-74-13) NEUTRON EMISSION STUDY AFTER MUON CAPTURE BY NUCLEI. Bouyssy, A. (Paris-11 Univ., 91 - Orsay (France)). 1974. 170p. (In French). INIS.

Muon capture by nuclei, used in the beginning for checking the weak interaction, is now a method of investigation of nuclear structure. Study of spectrum, asymmetry, and polarization of emitted neutrons after polarized muon capture was done in three directions: weak coupling constants, final state interaction, nuclear wave functions. The neutron intensity and helicity are very dependent on the neutron-residual nucleus interaction, while the asymmetry is sensitive to the wave functions used for the proton. Moreover if the induced tensor coupling constant is different from zero the asymmetry is increased. Longitudinal polarization experiments, with those for neutron intensity, would be of great interest to give information on neutron asymmetry. (FR)

10796 (JINR-P3-8800) INDEPENDENT DETERMINATION OF α-WIDTH OF 3.42 eV RESONANCE IN THE REACTION $^{147}Sm(n,\alpha)^{144}Nd$. Btyurin, V. A.; Nedvedyuk, K.; Popov, Yu. P.; Salatskii, V. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The α-width of 3.42 eV resonance of samarium-147 has been determined by the new (as compared to the previously used) method: over the ratio of the α-particle yield from the reaction $^{147}Sm(n,\alpha)$ to the triton yield from the reaction $^{6}Li(n,t)$ at the same energy. The value has been obtained $\Gamma = 1.8 \pm 0.2$ μ eV. 2 tables, 2 figures. (auth)

10797 (JINR-R9-7339, pp 200-206) STUDY ON NUCLEAR STRUCTURE AND NUCLEAR REACTION MECHANISM ON AN ISOCHRONOUS CYCLOTRON. Bem, P.; Krzhemenek, Ya.; Kroga, V.; Piskorzh, Sh.; Tsejpek, Ya. (Ustav Jaderne Fyziky, Rez, Czech.). 1973. (In Russian).

From 3rd symposium on the isochronous cyclotron U-120M and its uses for studies on nuclear physics; Ceske Budejovice, Czechoslovakia (14 May 1973). (Joint Inst. for Nuclear Research, Dubna (USSR)).

The results of use of the U-120 cyclotron at the Nuclear Physics Institute are presented, and proposed studies on nuclear structure and nuclear reaction mechanisms using modernized cyclotrons are summarized. Proposals are presented for studies on inelastic scattering of protons and complex particles, direct reactions of transformation of one or several nucleons, stripping reactions, and pick-up of two nucleons, and analog states in elastic and inelastic scattering. (tr-auth)

10798 (JINR-R9-7339, pp 233-246) STUDY ON NUCLEAR STRUCTURE BY MEANS OF REACTIONS (CHARGED PARTICLE, xγn). Adam, I.; Shpalek, A. (Ustav Jaderne Fyziky, Rez, Czech.). 1973. (In Russian).

From 3rd symposium on the isochronous cyclotron U-120M and its uses for studies on nuclear physics; Ceske Budejovice, Czechoslovakia (14 May 1973). (Joint Inst. for Nuclear Research, Dubna (USSR)).

Separate aspects are reported of the study of the structure of even-even deformed nuclei using the (charged particle, xγn) reaction on the U-120M isochronous cyclotron and of the possibility of using this cyclotron for similar studies at incident beam energies of around 50 MeV. (INIS)

10799 (JUL-Conf-16(Vol. 1), pp 19) INIDCATION OF AN E4 GIANT RESONANCE. Geramb, H. V.; Amos, K. A. (Univ. of Melbourne, Victoria, Australia). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10800 (JUL-Conf-16(Vol. 1), pp 20) GIANT QUADRUPOLE RESONANCE IN ^{89}Y EXCITED BY DEUTERON-, ^{3}He- AND α-PARTICLE INELASTIC SCATTERING. Rogge, M.; Turek, P.; Wiktor, S.; Djaloeis, A.; Mayer-Boericke, C. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10801 (JUL-Conf-16(Vol. 1), pp 21) MULTIPOLE RESONANCES IN SPHERICAL NUCLEI. Eramzhyan, R. A.; Fedotov, S. I.; Stoyanov, C.; Vdovin, A. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10802 (JUL-Conf-16(Vol. 1), pp 22) GAMOW-TELLER STRENGTH OBSERVED IN (p,n) REACTIONS. Doering, R. R.; Galonsky, A.; Bertsch, G. F. (Michigan State Univ., East Lansing). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei; Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10803 (JUL-Conf-16(Vol. 1), pp 23) ELECTROEXCITATION OF GIANT RESONANCES IN $^{143,150}Nd$ AND ^{206}Pb. Frey, R.; Schwierczinski, A.; Spamer, E.; Theissen, H.; Walcher, T. (Technishce Hochschule, Darmstadt, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10804 (JUL-Conf-16(Vol. 1), pp 45) SEARCH FOR LATERAL BANDS IN ^{100}Ru, ^{150}Sm, AND ^{152}Dy. de Voigt, M. J. A.; Jansen, J. F. W.; Sujkowski, Z.; Chmielewska, D.; van Klinken, J.; Feenstra, S. (Univ. of Groningen, Netherlands). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10805 (JUL-Conf-16(Vol. 1), pp 46) POPULATION OF A NEW ISOMER IN ^{104}Rh FROM LOW AND HIGH SPIN COMPOUND STATES. Harrach, D.; Rabenstein, D. (Technischen Univ., Munich). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10806 (JUL-Conf-16(Vol. 1), pp 47) TWO-QUASIPARTICLES-PLUS-ROTOR CALCULATIONS OF CORIOLIS DECOUPLING. Flaum, C.; Cline, D. (Univ. of Rochester, NY). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10807 (JUL-Conf-16(Vol.1), pp 48) POSSIBLE COEXISTENCE OF PROLATE AND OBLATE SHAPES IN ^{133}Ba. Gizon, J.; Gizon, A.; Horen, D. J. (Institut des Sciences Nucleaires, Grenoble, France). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23--26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10808 (JUL-Conf-16(Vol. 1), pp 50) HIGH SPIN STATES IN ^{136}Ce. Mueller-Veggian, M.; Lieder, R. M.; Neskakis, A.; Gono, Y.; Mayer-Boericke, C. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10809 (JUL-Conf-16(Vol. 1), pp 51) LEVELS IN THE CLOSED-NEUTRON-SHELL NUCLEUS ^{142}Nd. Dehnhardt, W.; Mills, S. J.; Mueller-Veggian, M.; Neumann, U.; Pelte, D.; Povh, B. (Univ., Heidelberg, Ger.). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10810 (JUL-Conf-16(Vol. 1), pp 52) HIGH-SPIN STATES AND EVIDENCE FOR PARTICLE-CORE COUPLING IN THE N = 83, $^{143}_{60}$Nd, $^{145}_{62}$Sm, AND $^{147}_{64}$Gd NUCLEI. Haratym, Z. (Inst. of Nuclear Research, Swierk, Poland); Kownacki, J.; Ludziejewski, J.; Sujkowski, Z.; De Geer, L. E.; Kerek, A.; Ryde, H. Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
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10811 (JUL-Conf-16(Vol. 1), pp 53) HIGH-SPIN STATES IN $^{141}_{60}Nd_{81}$ OBSERVED IN THE (α,2nγ) REACTION. Haratym, Z. (Inst. of Nuclear Research, Swierk, Poland); Kownacki, J.; Ludziejewski, J.; De Geer, L. E.; Kerek, A. Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
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10812 (JUL-Conf-16(Vol. 1), pp 54) HIGH j SINGLE PARTICLE EXCITATIONS IN 83 < N < 89 NUCLEI. Bjerragaard, J.; Ellegaard, C.; Kleinheinz, P.; Knudsen, P.; Lien, J. R.; Loevhoeiden, G.; Rekstad, J. (Niels Bohr Inst., Copenhagen). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
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10813 (JUL-Conf-16(Vol. 1), pp 55) STRONGLY DEFORMED CONFIGURATIONS IN N = 87 NUCLEI. Kleinheinz, P.; Stefanini, A.; Maier, M. R.; Sheline, R. K.; Stephens, F. S.; Diamond, R. M. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.
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In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10814 (JUL-Conf-16(Vol. 1), pp 97) INNER HOLE STATES IN HEAVY NUCLEI WITH THE (τ,α) REACTION AT 205 MeV. Gerlic, E.; Kaelne, J.; Langevin-Joliot, H.; Van de Wiele, J.; Duhamel, G. (Inst. de Physique Nucleaire, Orsay, France). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10815 (JUL-Conf-16(Vol. 1), pp 98) DEEPLY BOUND HOLE STATES AND ISOBARIC ANALOG STATES EXCITED BY (p,d) REACTIONS ON TIN ISOTOPES. Sekiguchi, M.; Sakai, M.; Shida, Y.; Soga, F.; Hirao, Y. (Univ. of Tokyo). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10816 (JUL-Conf-16(Vol. 1), pp 99) HIGHLY EXCITED LEVEL STRUCTURES OF ^{115,117,119}Sn VIA (τ,α) REACTIONS. Sakai, M.; Sekiguchi, M.; Soga, F.; Shida, Y.; Hirao, Y. (Univ. of Tokyo). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10817 (JUL-Conf-16(Vol. 1), pp 109) SEMIMICROSCOPIC CALCULATION OF THE NEUTRON STRENGTH FUNCTION IN Sn ISOTOPES. Soloviev, V. G.; Stoyanov, C.; Dumbasuren, D.; Vdovin, A. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
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10818 (JUL-Conf-16(Vol. 1), pp vp) BEAM LIFETIME MEASUREMENTS WITH CONVERSION ELECTRONS. Brock, R.; Guenther, C.; Huebel, H.; Schneider, W. D. (Univ., Bonn). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10819 (LYCEN-75-92, pp 1-2 (Pt.S4)) SELF-CONSISTENT CALCULATIONS OF DEFORMATION PROPERTIES OF SAMARIUM EVEN ISOTOPES. Decharge, J.; Girod, M.; Gogny, D. [nd]. (In French).
From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).
In 3rd biennial session of nuclear physics. La Toussuire, 10–15 February 1975. (Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire).
Hartree–Fock calculations were performed for Samarium isotopes with a finite range density-dependent force. This calculation gives a remarkable fit to deformed properties of these nuclei. (FR)

10820 SHELL-SHIFTED EQUI-SPACING MODEL FOR PARTICLE–HOLE STATE DENSITIES. Kalbach, C. (CEN de Saclay, Gif-sur-Yvette, France). Nuovo Cim.; 29A: No. 2, 283-298(21 Sep 1975).

A simple method is proposed for the calculation of particle-hole state densities containing the main effects of shell structure. The method consists of introducing a shell gap into a set of equally spaced single-particle states. State densities can then be calculated using the simple equi-spacing model formulas but with the Pauli energy and effective values of the single-particle and single-hole state densities evaluated for the set of shell-shifted single-particle states. Quite reasonable agreement is obtained with the results of more realistic and detailed numerical calculations, and the present shell-corrected state densities seem to be suitable for inclusion in pre-equilibrium reaction model calculations. (auth)

10821 (^{18}O, ^{16}O) REACTION ON EVEN TIN ISOTOPES. Bohlen, G. H.; Hildenbrand, K. D. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)); Gobbi, A. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)); Kubo, K. I. (Tokyo Univ. (Japan). Dept. of Physics). Z. Phys., A; 273: No. 2, 211-219(Jun 1975).

6 figs.; 3 tabs.; 34 refs.

The two-neutron transfer reaction $^{(A)}$Sn(^{18}O,^{16}O)$^{(A+2)}$Sn has been measured for the isotopes A = 112, 116, 118, 120, 122, and 124 bombarding energies of 57 and 60 MeV together with the elastic scattering. Angular distributions have been analyzed for the transitions to the ground state and to the first excited 2^+ state. The observed ground state transition is strongly enhanced. The theoretical DWBA analysis is performed with a finite range 2n-transfer form factor including recoil correction. The calculated cross section reproduces the observed systematic change over all isotopes. The absolute cross sections are normalized by a factor of 4.7 and 7.5, depending on the two different sets of 2n-wave functions used in the analysis. The results confirm the prediction of the pairing model that the transition strengths of a neutron pair between the ground states of even tin isotopes are the same. (auth)

10822 MEASUREMENTS OF G-FACTOR IN ^{94}Mo. Faestermann, T.; Feilitzsch, F.; Raghavan, R. S.; Signorini, C.; Yamazaki, T. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Department); Baba, C. V. K.; Fossan, D. B.; Proetel, D. (Muenchen Univ. (F. R. Germany). Sektion Physik). Z. Phys., A; 273: No. 2, 157-161(Jun 1975).

4 figs.; 1 tab.; 18 refs.

The nuclear g-factor of the 8_1^+ state in ^{94}Mo at E = 2,953 keV has been measured to be g = 1.317 ± 0.015 with the time differential PAD technique following the ^{92}Zr(α,2n)^{94}Mo reaction at E = 24 MeV. This value fits fairly well with the present knowledge of magnetic moment systematics in the A approximately 90 region. An improved determination of the half life of this state has been obtained as t = 98 ± 2 nsec. (auth)

10823 DELAYED NEUTRON EMISSION PROBABILITIES OF ^{92,93}Kr, ^{92,93}Rb, ^{141,142}Xe, AND ^{141,142}Cs PRECURSORS. Asghar, M.; Crancon, J.; Gautheron, J. P.; Ristori, C. (CEN, Grenoble, France). J. Inorg. Nucl. Chem.; 37: No. 7/8, 1563-1567(Jul 1975).

Delayed-neutron emission probabilities P_n of ^{92,93}Kr, ^{92,93}Rb, ^{141,142}Xe and ^{141,142}Cs have been obtained using an on-line isotope separator. β and neutron activities were measured with a 0.955 × 4π β detector and a neutron detector whose efficiency of neutron detection was reasonably independent of neutron energy. All the possible corrections and errors were looked into and applied to the data. The precursors and P_n-values determined in this work are ^{92}Kr, 0.0323%; ^{92}Rb, 0.0125%; ^{93}Kr, 1.92%; ^{93}Rb, 1.164%; ^{141}Xe, 0.0426%; ^{141}Cs, 0.0529%; ^{142}Xe, 0.406%; and ^{142}Cs, 0.285%. These values are ~ 2 to 3 times more precise than the existing data. (auth)

10824 NEUTRON-CAPTURE GAMMA RAYS FROM ^{116}Sn AND ^{122}Sn AND THE VALENCE MODEL. Bhat, M.R.; Chrien, R.E.; Cole, G.W.; Wasson, O.A. (Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. C 12: No. 5, 1457-1461 (Nov 1975).

Capture γ-ray intensities from resonances of ^{116}Sn and ^{122}Sn have been measured. The results lead to binding energies of 6944 ± 2.0 keV for the product nucleus ^{117}Sn and 5948 ± 3.0 keV for the product nucleus ^{123}Sn. Resonance spins were determined: in ^{116}Sn, E_0 = 147.9 and E_0 = 632 eV resonances are $J = 3/2$, $l = 1$; in ^{122}Sn, E_0 = 106.9 eV resonance is $J = 3/2$, $l = 1$; E_0 = 259.9 eV resonance is $J = 1/2$, $l = 1$. The measured partial widths are compared to single-particle transition model predictions. The model fails to predict the observed widths. (auth)

10825 QUADRUPOLE MOMENTS OF 2^+ STATES OF EVEN TIN ISOTOPES. Graetzer, R.; Cohick, S.M. (Department of Physics, The Pennsylvania State University, University Park, Pennsylvania 16802); Saladin, J.X. Phys. Rev. C 12: No. 5, 1462-1468 (Nov 1975).

In high precision Coulomb excitation experiments α particles of 10.0, 10.5, and 10.6 MeV and ^{16}O ions of 42.0 and 46.0 MeV were used to excite the first 2^+ states in ^{112,116,118,130,122,124}Sn. Static quadrupole moments Q (2^+) and reduced quadrupole transition probabilities B ($E2$; $0^+ \rightarrow 2^+$) were extracted from intensities of particles elastically and inelastically scattered at angles near 173° into an annular detector. The values of Q (2^+) are very small and consistent with 0.0 b. These results are in agreement with theoretical predictions based on pairing plus quadrupole forces. (auth)

10826 SPIN-DEPENDENT POTENTIALS FOR DEUTERON-NUCLEUS SCATTERING. Knutson, L.D.; Haeberli, W. (University of Wisconsin, Madison, Wisconsin 53706). Phys. Rev. C 12: No. 5, 1469-1477 (Nov 1975).

Measurements of the cross section, the vector analyzing power, and the three tensor analyzing powers for deuteron elastic scattering from ^{90}Zr at 5.5 MeV and from ^{208}Pb at 9.0 MeV are presented. These measurements and additional measurements obtained from the literature are analyzed in terms of the optical model. The folding model is used to calculate the spin-dependent potentials from the known nucleon-nucleus potentials, and the central terms in the optical potential are determined empirically. Acceptable agreement is obtained for the cross section and vector analyzing power. The calculations reproduce the observed tensor analyzing powers for sub-Coulomb energies but not for energies above the Coulomb barrier. (auth)

10827 BACK-ANGLE ELASTIC ALPHA SCATTERING FROM ^{89}Y AND ^{90,91,94}Zr. Wit, M.; Schiele, J.; Eberhard, K.A. (Sektion Physik, Universität Müncheon, D-8046 Garching, Germany); Schiffer, J.P. Phys. Rev. C 12: No. 5, 1447-1451 (Nov 1975).

Excitation functions and angular distributions for elastic α scattering from target nuclei around $A = 90$ have been measured in an effort to obtain a precise picture of the cross sections at backward angles. Excitation functions between E_α(lab) = 18 through 25 MeV for α + ^{89}Y and α + ^{90,91,94}Zr have been measured in steps of 500 keV or less at angles between 141° and 176° (lab). Near 180°, narrow (about 1 MeV minima, with a drop in cross section by more than an order of magnitude, are observed around E_α = 23 MeV for the α + ^{89}Y and α + ^{90,91}Zr elastic scattering. A similar, but less pronounced, structure is seen in the excitation function for α + ^{94}Zr. Angular distributions between 48.5° and 176° (lab) measured at several energies in 2.5° steps show a regular, diffractionlike pattern over the entire angular range. A standard four-parameter Woods-Saxon potential is found to be sufficient to provide a detailed fit to the experimental data including the minima in the excitation functions at back angles. (auth)

10828 NUCLEAR ORIENTATION OF ^{106}Ag^m. Schoeters, E.; Geerts, R.; Silverans, R.E.; Vanneste, L. (Instituut voor Kern- en Stralingsfysika, Leuven University, 3030 Heverlee, Belgium). Phys. Rev. C 12: No. 5, 1680-1683 (Nov 1975).

Nuclei of ^{106}Ag^m embedded in an iron matrix have been oriented at low temperatures. The decay to ^{106}Pd allowed determination of the spin values for the levels at 2366 keV ($J = 4$), 2351 keV ($J = 4$), 2283 keV ($J = 4$), 2077 keV ($J = 4$), and 1932 keV ($J = 4$). The $E2$ fractions $Q = \delta^2/(1 + \delta^2)$ could be deduced for 12 mixed $M1$-$E2$ transitions (energies in keV): Q (222) = 0.017 ± 0.005, $\delta < 0$; Q (391) = $0.996^{+0.004}_{-0.006}$, $\delta < 0$; Q (406) = 0.91 ± 0.01, $\delta < 0$; Q (430) = 0.982 ± 0.003, $\delta < 0$; Q (474) = 0.01 ± 0.01 or Q (474) = 0.94 ± 0.02, $\delta < 0$; Q (601) = 0.03 ± 0.03 or Q (601) = $0.90^{+0.03}_{-0.06}$, $\delta < 0$; Q (616) = 0.990 ± 0.005, $\delta < 0$; Q (703) = 0.54 ± 0.14, $\delta < 0$ or Q (703) = 1.00−0.04, $\delta > 0$ or $\delta < 0$; Q (793) = 0.00 + 0.01, $\delta > 0$ or Q (793) = $0.980^{+0.005}_{-0.020}$, $\delta < 0$; Q (825) = 0.002 ± 0.002 or Q (825) = 0.97 ± 0.01, $\delta < 0$; Q (1046) = 0.005 ± 0.003, $\delta < 0$; Q (1528) = 0.07 ± 0.01 or Q (1528) = 0.84 ± 0.02, $\delta < 0$. In addition, the magnetic moment of 6^+ isomeric state of ^{106}Ag was determined to be $|\mu|$ = (2.8 ± 0.2) μ_N. (auth)

10829 STRUCTURE OF $1f_{7/2}$ AND $1g_{9/2}$ NUCLEI. Heras, C.A.; Abecasis, S.M. (Laboratorio de Radiaciones, Departamento de Fisica, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Ciudad Universitaria, Nuñez, Buenos Aires, Argentina). Phys. Rev. C 12: No. 5, 1659-1670 (Nov 1975).

In order to investigate some approximations involved in the generalized semimicroscopic model (GSMM), a cluster-phonon model is presented in which a hole or two holes and one particle are coupled between them through Q-Q plus pairing interactions, and to the quadrupole vibrations of a doubly even core having a closed shell. Anharmonicities are also included phenomenologically. Matrix elements are computed using graphical methods and numerical calculations are performed for ^{57}Co and ^{115}In, selected as well known examples of odd-mass nuclei in the $1f_{7/2}$ and $1g_{9/2}$ shells, respectively. A good fit to energy levels is achieved through a reasonable variation of the model parameters, and the predictions of the GSMM about the nature of the low-lying levels in both nuclei are confirmed. The calculated electromagnetic properties and spectroscopic factors compare favorably with experiment except for some discrepancies in ^{115}In. (auth)

10830 HALF-LIVES OF ^{129m}Xe, ^{131m}Xe, ^{133m}Xe, ^{133}Xe, AND ^{135}Xe. Hoffman, D. C.; Barnes, J. W.; Dropesky, B. J.; Law-

rence, F. O.; Kelley, G. M.; Ott, M. A. (Los Alamos Scientific Lab., NM). J. Inorg. Nucl. Chem.; 37: No. 11, 2336(Nov 1975).

The half-lives of several Xe isotopes were remeasured because accurate values were needed in determinations of the isomer ratios and yields of the Xe isotopes from various types of fission. The Xe isotopes were produced by neutron irradiation of Xe gas samples in the Los Alamos Omega West Reactor. The Xe isotopes were then mass separated and the β decay of the resulting fractions was followed with end-window gas proportional counters for more than eight half-lives. The values obtained were: 8.87 ± 0.03 days for ^{129m}Xe; 11.92 ± 0.03 days for ^{131m}Xe; 2.19 ± 0.05 days for ^{133m}Xe; 5.25 ± 0.02 days for ^{133}Xe; 9.104 ± 0.020 hr for ^{135}Xe: These values are compared with those reported by other workers. (UK)

10831 IDENTIFICATION OF ^{96}Y IN FISSION BY A RAPID CHEMICAL SEPARATION PROCEDURE. Klein, G.; Kaffrell, N.; Trautmann, N.; Herrmann, G. (Univ., Mainz). J. Inorg. Nucl. Chem.; 11: No. 7-8, 511-518(Jul 1975).

A new nuclide, ^{96}Y, has been identified by a rapid chemical separation of yttrium from fission products, and by the bombardment of ^{96}Zr with 14-MeV neutrons. The half-life was determined to be 9.6 ± 0.3 sec, and 16 γ-rays were assigned to the decay of ^{96}Y. Evidence for a 1.5 ± 0.3 sec ^{97}Y has been obtained. (auth)

10832 DELAYED NEUTRON EMISSION PROBABILITIES OF ^{92,93}Kr, ^{92,93}Rb, ^{141,142}Xe, AND ^{141,142}Cs PRECURSORS. Asghar, M.; Crancon, J.; Gautheron, J. P.; Ristori, C. (CEN, Grenoble, France). J. Inorg. Nucl. Chem.; 37: No. 11, 2229-2233(Nov 1975).

Delayed-neutron emission probabilities P_n of ^{92,93}Kr, ^{92,93}Rb, ^{141,142}Xe and ^{141,142}Cs have been obtained using an on-line isotope separator. β- and neutron activities were measured with a 0.955 × 4π − β detector and a neutron detector whose efficiency of neutron detection was reasonably independent of neutron energy. All the possible corrections and errors were looked into and applied to the data. The precursors and P_n-values determined in this work are ^{92}Kr, 0.0323%; ^{92}Rb, 0.0125%; ^{93}Kr, 1.92%; ^{93}Rb, 1.164%; ^{141}Xe, 0.0426%; ^{141}Cs, 0.0529% ^{142}Xe, 0.406%; and ^{142}Cs, 0.285%. These values are ~ 2 to 3 times more precise than the existing data. (auth)

10833 DECAYS OF ^{126}Ba AND ^{126}Cs. Pathak, B. P.; Preiss, I. L. (Rensselaer Polytechnic Inst., Troy, NY). J. Inorg. Nucl. Chem.; 37: No. 11, 2223-2228(Nov 1975).

The γ-ray spectra associated with the decay of ^{126}Ba in equilibrium with its daughter ^{126}Cs have been studied with the use of a 50 cm^{3}Ge (Li) and a thin window intrinsic Ge detector. A large number of γ-rays have been observed to decay with a 100 ± 2 min half-life and are assigned to ^{126}Ba and its shortlived ($T_{½}$ = 1.6 min) daughter ^{126}Cs. Preliminary measurements of γ-γ coincidences have been performed using two Ge(Li) detectors and a 4096 × 4096 two parameter analyzer. Partial decay schemes of ^{126}Ba and ^{126}Cs are suggested. (auth)

10834 EXPERIMENTAL AND THEORETICAL INVESTIGATION OF ANOMALOUS BEHAVIOR IN ROTATIONAL BANDS AT HIGH SPIN. Flaum, C. Rochester, NY; Univ. of Rochester (1975). 120p. University Microfilms Order No. 75-22,740.

Thesis (Ph. D.).

High spin states of the barium nuclei have been investigated via the ^{114}Cd(^{16}O,4n)^{126}Ba, ^{120}Sn(^{12}C,4n)^{128}Ba and ^{124}Sn(^{12}C,4n)^{132}Ba reactions. The even spin positive parity yrast band in ^{126}Ba has been excited up to the 16$^+$, and possibly the 18$^+$ state. This band exhibits considerable backbending, starting between the 10$^+$ and 12$^+$ states. A second 12$^+$ state, which appears to be an extension of the ground state band has also been excited in this nucleus. In addition, another strongly excited band was excited with spins and parities: 7$^-$, 9$^-$, 11$^-$, 13$^-$ and 15$^-$. In ^{128}Ba, the even spin positive parity band has been excited up to the 12$^+$ state. Backbending seems to begin at the 12$^+$ state. Two-quasiparticles-plus-rotor bandmixing calculations have been performed in order to explain the backbending and the anomalous negative parity bands observed in ^{126,128}Ba and several other nuclei. The test case of $^{156}_{68}$Er$_{88}$ was studied in detail. Good agreement with experimental excitation energies was obtained. The E2 transition rates between the negative parity yrast states were estimated for ^{156}Er. Strongly enhanced rates are found within the states of odd spin, and within the state of even spin, but interconnecting rates are reduced. The values of the g-factors were also estimated for the two-quasineutron yrast states in ^{156}Er, showing considerable deviations from the rotational values. The calculation was applied, with very similar results to $^{126}_{56}$Ba$_{70}$. The h/sub 11/2/ proton orbit is found to play the major role in the backbending and the anomalous negative parity band. Reasonable fits to the excitation energies were obtained. The case of $^{104}_{46}$Pd$_{58}$ was considered, since it is nearly a neutron analogue of the proton configuration in ^{126}Ba. Very similar results were obtained, with excellent fits to the known excitation energies. The nucleus $^{192}_{80}$Hg$_{112}$ was also studied. Although the calculation reproduced the extreme backbending, no reasonable fit was obtained for the negative parity states. The above evidence suggests that decoupling effects are responsible for the anomalous high spin behavior of the nuclei considered. The validity of a new coupling scheme, in which the projection of the intrinsic spin on the rotation axis becomes a good quantum number, is clearly demonstrated. (Diss. Abstr. Int., B)

10835 COULOMB EXCITATION STUDIES OF EVEN-EVEN NUCLEI $^{154\ 155\ 156\ 157\ 158\ 159\ 160}$Gd AND $^{176\ 177\ 178\ 179\ 180}$Hf, AND MEAN LIFE MEASUREMENTS IN $^{72\ 74}$Se. Ronningen, R. M. Nashville; Vanderbilt Univ. (1975). 220p. University Microfilms Order No. 75-21,605.

Thesis (Ph. D.).

Coulomb excitation studies of $^{154\ 155\ 156\ 157\ 158\ 159\ 160}$Gd and $^{176\ 177\ 178\ 179\ 180}$Hf were made via the (alpha,alpha') reaction using the Oak Ridge National Laboratory Tandem Van de Graaff accelerator, Enge split-pole magnetic spectrograph, and a 20 cm long, position sensitive proportional counter. Values of B(E2; 0$^+$g yields 2$^+$g) were extracted for all these Gd and Hf nuclei. For $^{156\ 157\ 158\ 159\ 160}$Gd and $^{178\ 180}$Hf, the E4 reduced matrix elements, between 0$^+$g and 4$^+$g, were also deduced. Measurements of absolute B(E2) and B(E3) values for excitations of vibrational-like K/sup pi/I equals 0$^+$2, 2$^+$2, and I/sup pi/ equals 3$^-$ states were made. Systematic studies and comparisons to other measurements are given. The multiple excitation problem with alpha-particles is studied. Delayed coincidence techniques were applied in obtaining the mean lives (tau) of the first excited 0$^+$ states in $^{72\ 74}$Se, and rho, the E0 reduced matrix element in ^{72}Se. B(E2; 0_2^+–2_1^+) values are deduced and with 6$^+$, 4$^+$ mean life data a shape coexistence model is tested. Systematic studies of tau, rho, B(E2) values and energy levels of some nuclei with A less than or equal to 100 are made as well as phenomenological model applications to bands built over these excited 0_2^+ states. (auth)

10836 NUCLEAR DATA SHEETS FOR A equals 115. Raman, S.; Kim, H. J. (Oak Ridge National Lab., TN). Nucl. Data Sheets; 16: No. 2, 195-230(Oct 1975).

The 1960 version of Nuclear Data Sheets for A equals 115 has been revised on the basis of experimental data received before July 1974, with some modifications received via private communications. Experimental data concerning the nuclear structure of isotopes were compiled and used in the construction of the level schemes and in the deduction of numerous level properties and J/sup pi/-assignments. (auth)

10837 NUCLEAR DATA SHEETS FOR A equals 144. Burrows, T. W. (Univ. of Kentucky, Lexington); Auble, R. L. Nucl. Data Sheets; 16: No. 2, 231-266(Oct 1975).

The 1967 version of Nuclear Data Sheets for A equals 144 has been revised on the basis of experimental data received by February 7, 1975. Experimental data quoted in the 1967 version which have been largely superseded by more recent work have been omitted from the present revision. Data for which there have been no new measurements have only been summarized in the present revision. (auth)

10838 EXPERIMENTAL STUDIES OF VIBRATION-LIKE NUCLEI THROUGH THEIR ELECTROMAGNETIC PROPERTIES. Meyer, R. A. (Univ. of California, Livermore). pp 128-154 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

The influence of multiparticle effects on vibration-like nuclei is studied for odd mass nuclei in the region of Z equals 50 and N less than 82. A brief description of experimental techniques is followed by a look at how the inclusion of three quasi particle effects can provide a model consistent with these results. Included are two-particle, one-hole states in odd Sb nuclei, three-particle clustering in the I nuclei, and one-proton, two-neutron configurations near N equals 82. The effect of the Coriolis force on rotational structure in La and In is then considered along with a discussion of apparent deviation from vibrational character in N equals 81 nuclei. Finally, systematics of higher order electromagnetic processes in the Sn region are mentioned. 10 figures, 115 references. (SDF)

10839 NEW ASPECT OF THE QUASI-gamma BAND. Sakai, M. (Univ., Tokyo). pp 181-198 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

Experimental results for the ^{127}I(p,2n)^{126}Xe and ^{127}I(p,4n)^{124}Xe

reactions are presented. The nuclear properties previously known and recently discovered quasi-gamma bands are examined for consistency within the quasi band picture. B(E2) ratios for inter-band transitions are discussed and the energy spacing of the quasi-gamma band is compared with that of the quasi-ground band. Consideration is given to the relationship between phonon and rotational levels. 11 figures, 4 tables. (SDF)

10840 REORIENTATION EFFECT MEASUREMENTS OF THE VIBRATIONAL NUCLEI. Kleinfeld, A. M. (Univ., Cologne). pp 363-384 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

An outline is given of aspects of the semiclassical theory of Coulomb excitation relevant to reorientation studies of nuclei. This is followed by a discussion of the influence of nuclear interactions on the interpretation of the reorientation effect measurements. Experimental techniques, emphasizing recent developments, are briefly described in light of our understanding of the various corrections. Finally, a critical survey of reorientation results in the A = 100 region is presented. 1 table, 12 figs. (SDF)

10841 EXCITED STATE QUADRUPOLE MOMENT MEASUREMENTS IN THE Z = 50 REGION. Hall, I. (Univ. of Liverpool, Eng.). pp 385-395 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

Results of Coulomb reorientation measurements of the static electric quadrupole moments of the first excited 2^+ states of even-even nuclei in the Z = 50 region are discussed in the framework of a semimicroscopic particle-vibrator coupling model in which a few extra core protons or holes are coupled to a harmonic vibrational core. An overview is then given of all the reported quadrupole moment measurements on isotopes of Mo, Ru, Pd, Cd, Sn, and Te. 6 figures. (SDF)

10842 QUADRUPOLE MOMENT IN THE PARTICLE-VIBRATION COUPLING. Lopac, V. (Rudjer Boskovic Inst., Zagreb). pp 396-407 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

The mechanism leading to large static quadrupole moments in vibrational nuclei is studied in the framework of the particle-vibrator coupling model. The sensitivity of the model to parameter variation is discussed along with the limits of its applicability. Emphasis is on the case of two protons or proton holes coupled to the basic vibrator. 1 table, 4 figures. (SDF)

10843 EXPERIMENTAL STUDY OF THE PAIRING MODE OF ELEMENTARY EXCITATIONS. Flynn, E. R. (Los Alamos Scientific Lab., NM). pp 423-443 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

It is shown that the assumption of the pairing excitation as a true nuclear mode is verified experimentally. This is done first by showing results on the characteristics of the pairing excitation itself in several nuclear regions, and then considering the coupling of this excitation to the single particle mode. The excitations are considered first in the lead region where the experimental data cover a range of nuclei with up to three phonons present, a result not seen in the data available on the surface vibrational phonons. The N equals 50 region is then considered and it is seen that the pairing phonon characteristics are remarkably consistent over a range of elements and that this consistency permits the assignment of parentage to states not otherwise amenable to calculations. The coupling of this pairing mode to single particle states is then considered with ^{209}Pb presented as an example with comparisons to theoretical results. Additional results in the N equals 50 region also indicate an extension of these concepts to further assign nuclear spectroscopic information difficult by other methods. The collectivity of these phonons is clearly established. Finally, a brief treatment of the effect on the pairing excitations in the transition region is discussed. The emphasis here is on the rather little explored transition region near A equals 100 to indicate the usefulness of the systematic properties of the pairing mode in the study of such transition regions. 9 figures. (auth)

10844 NUCLEAR MASS SPECTROSCOPY WITH INTENSE PROTON BEAMS--PROPERTIES OF FAR-UNSTABLE NUCLEI. Hansen, P. G. (CERN, Geneva). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 363-372(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Progress in accelerator and target-ion-source techniques now permits a large number of experiments that would have been very difficult or impossible a few years ago. Intensities of the secondary, radioactive beams at the reconstructed ISOLDE at the CERN Synchrocyclotron are expected in favorable cases to reach 10^{10} to 10^{11} atoms per second of one mass number. As examples of recent experiments at CERN and elsewhere, nuclear ground-state properties and delayed-particle spectra are discussed. (auth)

10845 PION PRODUCTION IN NUCLEUS-NUCLEUS COLLISIONS. Schroeder, L. S. (Univ. of California, Berkeley). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 642-652(1975).

From 6th international conference on high energy physics and nuclear structure; Sante Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Current work on pion production in high energy nucleus-nucleus collisions is reviewed. The majority of existing data are of the inclusive variety in which a single final state pion is detected. Experimental data are compared and their possible contributions to obtaining new information on nuclear structure is discussed. Various models which attempt to explain the observed single-inclusive-pion spectra either on the basis of a nucleon-nucleus interaction in which Fermi motion is included or on some type of cooperative model are examined. Other areas of interest involving pion production include tests of charge symmetry and pion multiplicities. (auth)

10846 A STUDY OF THE REACTION ^{114}Cd(p,n)^{114}In. Hutcheon, D. A.; Gill, D. R. (Alberta Univ., Edmonton (Canada). Nuclear Research Centre). Nucl. Phys., A; 248: No. 3, 397-405(1 Sep 1975).

Gamma rays from the reaction ^{114}Cd(p,n)^{114}In have been detected in Ge(Li) counters in singles, in n-γ coincidence and in γ-γ coincidence. Direct timing measurements were carried out on γ-rays of 287, 312, 504, 634 and 693 keV. Angular distribution measurements restrict the spin of the 287 keV state to $J \leq 3$. (NL)

10847 DO RADIOACTIVE DECAY EVENTS FOLLOW A RANDOM POISSON-EXPONENTIAL. Berkson, J. (Mayo Clinic, Rochester, NY) Int. J. Appl. Radiat. Isot.; 26: No. 9, 543-549 (Sep 1975).

A series of 250,000 disintegration time intervals examined statistically was found to depart significantly from the Poisson-exponential distribution. The character of the discrepancy suggested possible instrumental error. It is recommended that the experiment be repeated. (auth)

10848 QUADRUPOLE PAIRING AND TWO-STEP EFFECTS IN EVEN Te(p,t) REACTIONS. Rangacharyulu, C.; Toki, H.; Aoki, Y.; Sano, M.; Yagi, K. (Osaka Univ.). Lett. Nuovo Cim.; 14: No. 3, 95-100(20 Sep 1975).

An attempt is made to explain the intensity trends and angular distribution patterns of both the ground and first L = 2 transitions, consistently for (p,t) studies on even $^{122-130}$Te isotopes with a 52-MeV beam. Ordinary DWBA calculations and those involving the two-step processes for 2_1^+ transitions are performed. (JFP)

Nuclear Properties and Reactions, 150 ≤ A ≤ 189

Refer also to abstracts 10734, 10748, 10784, 10792, 10798, 10803, 10806, 10812, 10813, 10819, 10820, 10835, 10979, 11021, 11036, and 11038.

10849 (COO-535-733, pp 123) PION ELASTIC SCATTERING FROM ALIGNED TARGETS. Iverson, M. S.; Rost, E. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10850 (COO-1265-170, pp 115-117) SEARCH FOR WEAK-COUPLING CORE EXCITED STATES IN ODD-Z HEAVY NUCLEI. Seltz, R.; Sharma, H. L. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10851 (COO-1265-170, pp 118-121) ANALYSIS OF TWO-PARTICLE TRANSFER REACTIONS ON DEFORMED AND SHAPE TRANSITION NUCLEI, 150 ≤ A ≤ 192. Hintz, N.; Sano, M.; Takemasa, T.; Wakai, M. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10852 (COO-1265-170, pp 159-168) ELASTIC AND INELASTIC SCATTERING OF ^{16}O ON THE EVEN Sm ISOTOPES. Weber, D.; Artz, J. L.; Shkolnik, V.; Dehnhard, D.; Hintz, N. M. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10853 (IPNO-T-75-02) STUDY OF THE PARITY VIOLATION IN NUCLEI: CIRCULAR POLARIZATION OF PHOTONS EMITTED IN A NUCLEAR TRANSITION. Desplanques, B. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France)). 1975. 138p. (In French). INIS.

Many experiments have shown parity violation in nuclear forces and a theoretical interpretation of these results should give some information on the weak interaction. The present work has to do with the calculation of the circular polarization of photons emitted in the transitions $5/2^+ \rightarrow 7/2^+$ in ^{181}Ta and $9/2^- \rightarrow 7/2^+$ in ^{175}Lu. This calculation has been done by employing a good description of the final and initial states and in particular by including the effects of the short and long range correlations. The results so obtained differ somewhat from those obtained previously with a simpler nuclear model and seem to favor weak interaction models with a large $\Delta T = 1$ component. (FR)

10854 (JUL-Conf-16(Vol. 1), pp 29) REMARK ON QUADRUPOLE VIBRATION CALCULATIONS. Hilton, R. R. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10855 (JUL-Conf-16(Vol. 1), pp 32) PAIRING-PLUS-STRETCHING MODEL FOR THE BACK-BENDING EFFECT. Gupta, R. K. (Univ., Frankfurt am Main). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

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10856 (JUL-Conf-16(Vol. 1), pp 56) $1/2^+$ ROTATIONAL BAND IN ^{151}Sm. Scheck, W.; Vandenput, G. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

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10857 (JUL-Conf-16(Vol. 1), pp 56) EXPERIMENTAL EVIDENCES FOR LOW-SPIN MEMBERS OF "UPPER" BANDS IN ^{156}Dy. El Masri, Y.; Janssens, R.; Michel, C.; Monseu, P.; Steyaert, J.; Vervier, J. (Inst. de Physique Corpusculaire, Louvain-la-Neuve, Belgium). Jul 1975.

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10858 (JUL-Conf-16(Vol. 1), pp 58) BACKBENDING: CORIOLIS ANTIPAIRING OR ROTATIONAL ALIGNMENT. Faessler, A.; Sandhya Devi, K. R.; Gruemmer, F.; Schmid, K. W. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

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10859 (JUL-Conf-16(Vol. 1), pp 59) DEFORMATION ENERGIES OF VERY HIGH-SPIN NUCLEI (I ≃ 20 TO 100). Neergard, K.; Pashkevich, V. V. (Joint Inst. for Nuclear Research, Dubna, USSR). Jul 1975.

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10860 (JUL-Conf-16(Vol. 1), pp 60) VERY HIGH SPIN STATES IN ^{162}Er. Faessler, A.; Sandhya Devi, K. R.; Gruemmer, F.; Schmid, K. W. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

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10861 (JUL-Conf-16(Vol.1), pp 61) MICROSCOPIC STUDY OF YRAST BAND IN Yb-NUCLEI. Ring, P.; Dafali, H. R.; Mang, H. J. (Univ. of California, Berkeley). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

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10862 (JUL-Conf-16(Vol. 1), pp 62) PARTICLE NUMBER CONSERVATION IN HIGH SPIN STATES. Gruemmer, F.; Schmid, K. W.; Faessler, A. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

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10863 (JUL-Conf-16(Vol. 1), pp 64) DETERMINATION OF THE MULTIPOLARITY AND AVERAGE DECAY PROBABILITY FOR THE GAMMA RAY CONTINUUM FOLLOWING HEAVY-ION REACTIONS. Trautmann, W.; Proetel, D.; Haeusser, O.; Hering, W.; Riess, F. (Univ., Munich, Garching, Ger.). Jul 1975.

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10864 (JUL-Conf-16(Vol. 1), pp 65) HIGH SPIN 4 QUASI-PARTICLE STATES IN ^{176}Hf. Khoo, T. L.; Bernthal, F. M.; Robertson, R. G. H.; Warner, R. A. (Michigan State Univ., East Lansing). Jul 1975.

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10865 (JUL-Conf-16(Vol. 1), pp 66) EVIDENCE FOR PROTON BACKBENDING IN THE Os REGION. Neskakis, A.; Lieder, R. M.; Beuscher, H.; Davidson, W. F.; Gono, Y.; Mueller-Veggian, M.; Mayer-Boericke, C. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

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10866 (JUL-Conf-16(Vol. 1), pp 67) ROTATIONAL BANDS BUILT ON HIGH-j ORBITALS IN ^{185}Ir AND ^{191}Ir. Andre, S. (Inst. des Sciences Nucleaires, Grenoble, France); Jastrzebski, J.; Kaczarowski, R.; Lukasiak, J.; Rivier, J.; Sebille-Schueck, C.; Treherne, J. Jul 1975.

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10867 (JUL-Conf-16(Vol.1), pp 68) HIGH-SPIN LEVEL STRUCTURE IN $^{188,194}Pt$. Daly, P. J. (Purdue Univ., Lafayette, IN); Piiparinen, M.; Cunnane, J. C.; Saha, S. K.; Dors, C. L.; Bernthal, F. M.; Khoo, T. L. Jul 1975.

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10868 (JUL-Conf-16(Vol. 1), pp 69) HIGH-SPIN STATES AND ROTATION ALIGNMENT IN EVEN Pt ISOTOPES. Hjorth, S. A. (Research Inst. for Physics, Stockholm); Johnson, A.; Lindblad, T.; Funke, L.; Kemnitz, P.; Winter, G.; Beshai, S.; Fransson, K. Jul 1975.

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10869 (JUL-Conf-16(Vol.1), pp 76) HIGH SPIN OCTUPOLE STATES IN FORMED NUCLEI. Vogel, P. (California Inst. of Tech., Pasadena). Jul 1975.

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In international symposium on highly excited states in nuclei, Juelich, 23--26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10870 (JUL-Conf-16(Vol. 1), pp 85) α-EMISSION BY PRECOMPOUND MECHANISM IN HEAVY NUCLEI. Milazzo-Colli, L. (CISE, Milan); Braga-Marcazzan, P. G.; Bonetti, R.; Milazzo, M. Jul 1975.

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10871 (JUL-Conf-16(Vol.1), pp 110) MEASUREMENT OF HALF-LIVES OF VERY NEUTRON DEFICIENT ISOTOPES IN THE RARE EARTH REGION. Machner, H.; Ernst, J.; Ibowski, R.; Mayer-Kuckuk, T.; Seeberger, U. (Univ., Bonn). Jul 1975.

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10872 (LYCEN-75-02, pp 1-5 (pt. S7)) WHAT CAN WE LEARN ON THE NUCLEAR STRUCTURE OF ODD-Z HEAVY NUCLEI WITH THE (p, t) REACTION. Seltz, R.; Sharma, H. L. [nd]. (In French).

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

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Preliminary results of (p, t) reactions on ^{181}Ta, ^{197}Au and ^{203}Tl, ^{205}Tl show several unknown $^7/_2^+$ levels in ^{179}Ta and $^3/_2^+$ levels in ^{197}Au. A weak-coupling core excited nature is suggested for this level. (FR)

10873 RESONANCE ACTIVATION INTEGRALS OF SOME LANTHANIDE NUCLIDES. Steinnes, E. (Institutt for Atomenergi, Kjeller, Norway). J. Inorg. Nucl. Chem.; 37: No. $^7/_8$, 1591-1592(Jul 1975).

The resonance activation integrals were determined for the following nuclides: ^{139}La, ^{148}Nd, ^{150}Nd, ^{151}Eu, ^{158}Gd, ^{164}Dy, ^{165}Ho, ^{170}Er, ^{176}Yb and ^{175}Lu. The determinations were based on cadmium ratio measurements and known values for the thermal neutron activation cross-sections. Small samples of ^{197}Au (σ_0 = 98.8 b, I_0 = 1550 b) were used as flux monitors. (auth)

10874 DEFORMATION PARAMETERS OF THE CHARGE DISTRIBUTION AND THE OPTICAL POTENTIAL FOR SOME NUCLEI IN AND NEAR THE RARE EARTH REGION. Lee, I.Y.; Saladin, J.X.; Holden, J.; O'Brien, J.; Baktash, C. (University of Pittsburgh, Pittsburgh, Pennsylvania 15260); Bemis, C. Jr.; Stelson, P.H.; McGowan, F.K.; Milner, W.T.; Ford, J.L.C. Jr.; Robinson, R.L.; Tuttle, W. Phys. Rev. C 12: No. 5, 1483-1494 (Nov 1975).

Elastic and inelastic scattering of α particles on ^{154}Sm, ^{166}Er, ^{168}Er, ^{182}W, ^{184}W, and ^{186}W was performed with incident energies between 11 and 21 MeV. Excitation functions for 0^+, 2^+, and 4^+ states of the ground-state rotational band were measured. Pronounced destructive nuclear-Coulomb interference effects were observed. Reduced $E2$ and $E4$ transition moments, and charge and optical-potential deformation parameters were determined from coupled-channel analysis of both the sub-Coulomb and interference data. (auth)

10875 ONE-NEUTRON TRANSFER REACTIONS TO ^{150}Sm. Oelert, W.; Maher, J.V.; Sink, D.A.; Spisak, M.J. (Nuclear Physics Laboratory, University of Pittsburgh, Pittsburgh, Pennsylvania 15260). Phys. Rev. C 12: No. 5, 1495-1506 (Nov 1975).

The (d, t) reaction on ^{151}Sm has been investigated at a deuteron energy of 17 MeV; the (d, p) reaction on the isotope ^{149}Sm at a deuteron energy of 12.5 MeV. For the stripping reaction angular distributions were taken in 2.5° steps in the range of $7.5° \leq \theta_{lab} \leq 35°$ and in 5° steps for $35° \leq \theta \leq 60°$. The experimental energy resolution is 10–12 keV full width at half-maximum (FWHM). For the pickup reaction angular distributions were taken in 2.5° steps in the range of $7.5° \leq \theta_{lab} \leq 30°$ and in 5° steps up to $\theta_{lab} = 45°$. The experimental energy resolution is 6–8 keV FWHM. Spectroscopic factors and l transfers were extracted by distorted-wave Born approximation analysis. The spectroscopic information is compared to one-nucleon transfer results of the lower mass Sm isotopes. (auth)

10876 HIGH SPIN STATES IN Dy ISOTOPES FROM MANY-BODY VARIATIONAL APPROACH. Warke, C.S. (Tata Institute of Fundamental Research, Bombay 5, India); Gunye, M.R. Phys. Rev. C 12: No. 5, 1647-1649 (Nov 1975).

The method of variation after angular momentum projection is applied to study the recently observed high-spin states and their electromagnetic properties in even-even Dy isotopes. The calculated B ($E2$) values and the energy spacings are in good agreement with the corresponding experimental results. (auth)

10877 DECAYS OF 2.45-h ^{179}Ta^m AND 23.8-min ^{179}Lu^m TO THE $K^\pi = 8^-$ LEVELS IN ^{179}Hf. Ward, T.E.; Chu, Y.Y. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. C 12: No. 5, 1632-1637 (Nov 1975).

The decays of the high-spin isomers of ^{179}Ta (2.45 h) and ^{179}Lu (23.8 min) to the two strongly admixed $K^\pi = 8^-$ states in ^{179}Hf were reinvestigated. The main features of the previously reported decay schemes are confirmed and several long-standing ambiguities are resolved. The results of this investigation indicate that the 1147-keV level is largely the two-neutron state and the 1479-keV level is largely the two-proton state in ^{179}Hf. They are found to be 34% admixed with one another. This mixing value is in good agreement with the value deduced from the $M1/E2$ cascade ratios of the 1147-keV band and from the comparison of the $E1$ ($\nu = 7$) hindrance factors of these two states in this mass region. The band-mixing matrix element for these two states was found to be in agreement with the recent theory which introduces the residual neutron-proton interaction to account for the mixing. The spin-parity of ^{179}Lu^m (23.8 min) was deduced to be $K^\pi = 9^-$ with a possible Nilsson configuration of $9/2^-[514]_n$, $9/2^+[624]_n$. (auth)

10878 OBSERVATION AND INTERPRETATION OF A SIDE BAND IN THE DEFORMED NUCLEUS ^{162}Er. Fenzl, M. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Department); Lieder, R. M.; Beuscher, H.; Davidson, W. F.; Neskakis, A.; Jaeger, H. M. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik). Z. Phys., A; 273: No. 2, 163-166(Jun 1975).

2 figs.; 1 tab.; 11 refs.

A side band in ^{162}Er was observed in (^{12}C, 4n) and (α, 4n) reactions using γ–γ coincidence and angular distribution measurements. The excitation energies and branching ratios were compared with the predictions of recent theoretical calculations. (auth)

10879 INVESTIGATION OF THE ^{159}Eu DECAY. Blinowska, K. J. (Warsaw Univ. (Poland). Instytut Fizyki Doswiadczalnej); Wessner, E. F. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Forschungszentrum). Z. Phys., A; 273: No. 2, 185-193(Jun 1975).

5 tabs.; 5 figs.; 21 refs.

An activity of ^{159}Eu was produced by an (n,p) reaction in an enriched gadolinium target by means of 14 MeV neutrons obtained from a SAMES generator. The gamma radiation accompanying the beta decay of ^{159}Eu into ^{159}Gd was detected by means of a Ge(Li) spectrometer. A 24-level decay scheme was devised and the transition probabilities were analyzed in terms of adiabatic theory and in terms of adiabatic theory and in terms of the theories including band mixing effects. The values of beta radiation intensities obtained from the experiment were compared with theoretical predictions calculated on the basis of the Nilsson model. (auth)

10880 FERMI AND GAMOW–TELLER EXCITED STATES IN DEFORMED NUCLEI. Gabrakov, S. I. (Univ., Sofia); Kuliev, A. A.; Schulz, H. Bulg. J. Phys.; 2: No. 2, 106-109(1975).

The properties of collective 0^+ and 1^+ states built of unlike particle-hole excitations in deformed nuclei were investigated in a microscopic approach. The numerical calculations were performed with Woods-Saxon wave functions. (auth)

10881 NUCLEAR SPINS OF ^{163}Lu, ^{168m}Lu, AND ^{172}Lu. Ekstroem, C.; Hogervorst, W.; Ingelman, S.; Wannberg, G. (Uppsala Univ.). Phys. Scr.; 10: No. 6, 301-303(Dec 1974).

The nuclear spins of some neutron-deficient lutetium isotopes have been measured using the atomic-beam magnetic resonance method. The following results have been obtained: ^{163}Lu (12 min) $I = ^1/_2$, ^{168m}Lu (6.7 min) $I = 3$ and ^{172}Lu (6.7 d) $I = 4$. The spin values are discussed within the framework of the Nilsson model. (auth)

10882 HIGH-SPIN EXCITATION MODES IN TRANSITIONAL NUCLEI STUDIES WITH (HI,xn) REACTIONS. Proetel, D. (Univ., Munich). pp 302-332 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

A brief introduction to the rotation-aligned coupling scheme, in which an odd particle in a high spin orbital is coupled to a moderately deformed rotating core, is followed by a discussion of new aspects of rotational bands in odd A transitional nuclei. New data on high spin states in classical vibrational nuclei are presented. It is seen that some even-even nuclei which exhibit moderate collectivity and for which their properties at low spin are thought to be vibrational, may change their character if forced to high angular momentum, as they are if produced in (HI,xn) reactions. For odd A nuclei, the rotation-aligned coupling scheme yields a useful description of properties of high spin states in moderately deformed nuclei. 2 tables, 23 figures. (SDF)

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 10697, 10705, 10732, 10734, 10744, 10814, 10820, 10826, 10842, 10850, 10851, 10867, 10870, 10872, 10882, 10945, 10957, and 10971.

10883 (COO-535-733, pp 5-7) (^{3}He,d) REACTION ON PLATINUM. Munger, M. L.; Peterson, R. J.; DiGiacomo, N.; Smith, G. 1 Nov 1975.

In technical progress report and proposal for continuation of contract. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics).

10884 (COO-1265-170, pp 122-128) GIANT RESONANCE IN ^{212}Po AND ^{213}At. Lilley, J. S.; Franey, M.; Becker, J. A. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10885 (COO-1265-170, pp 129-134) ALPHA-^{208}Pb INTERACTION POTENTIAL BELOW THE BARRIER. Becker, J. A.; Franey, M. A.; Lilley, J. S. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10886 (COO-2174-35) NEUTRON RESONANCE SPECTROSCOPY: ^{209}Bi. Singh, U. N.; Rainwater, J.; Liout, H. I.; Hacken, G.; Garg, J. B. (Columbia Univ., New York (USA)). 1975. 3p. (CONF-750303-81). Dep. NTIS $4.50.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

Neutron time-of-flight transmission measurements were made on several samples of ^{209}Bi by using the Nevis Synchrocyclotron of Columbia University. The resonance parameters are given for 29 levels to 75 keV. Out of the 29 observed levels 10 were l equals 0 and 19 were l equals 1 levels. The implied s and p strength functions are 10^4S_0 equals ($0.60^{+0.39}$/sub -0.21/) and 10^4S_1 equals ($0.19^{+0.08}$/sub -0.05/). 1 figure, 2 tables. (auth)

10887 (IN-2-P-3-CF-74-1, pp 1-16 (pt. 7A)) WEAK COUPLING STRUCTURE BY MEANS OF ISOBARIC ANALOG RESONANCE STUDY. Gales, S. [nd]. (In French).

From scientific meeting of the Tandem accelerator users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. Mont-Sainte-Odile, 15-17 May 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75-Paris (France)).

The particle decay of Isobaric Analog Resonances (I.A.R.) can reach weak coupling configurations in the parent states. The excitation function of the ^{209}Bi(d, p) reaction shows analog resonance of some weak coupling levels in ^{211}Bi whereas the ^{139}La (p, $p_{0,1}$) and ^{141}Pr(p, $p_{0,1}$) reactions show that the (d, p) reaction on the same target could not account for the mixing configurations in ^{138}La and ^{141}Pr. On another hand, the study of the sequential reaction (^{3}He, d p) on N = 28 nuclei strongly suits $f_{5/2}$, $g_{9/2}$ and $d_{5/2}$ I.A.R. and allows measurements of the coupling strength of these levels with the first 2^+ and 3^- states of the targets. (FR)

10888 (INIS-mf-1544, pp 227-232) STUDYING INTO THE Pb(n,2n) REACTION BY THE DOUBLE TIME-OF-FLIGHT METHOD. Voignier, J. (Centre de Etudes de Bruyeres-le-Chatel, Montrouge, France). 1974. (In French).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The angular correlation of neutrons emitted in the Pb(n,2n) reaction with 14-MeV neutrons was studied by a dual time-of-flight method. The method, which eliminates a large number of random or parasitic events, makes it possible to measure the correlation between angle and energy of two radiating neutrons. With a detector threshold of about 70 keV, the energy field is from 150 keV to 7 MeV. For an energy of impinging neutrons equal to 14 MeV, the curves of angular dispersion show that there is a slight correlation between the directions of emission of two neutrons. (tr-auth)

10889 (JUL-Conf-16(Vol.1), pp 17) EXPERIMENTAL DATA IN FAVOR OF MONOPOLE GIANT RESONANCE IN ^{40}Ca, ^{90}Zr, AND ^{208}Pb. Marty, N.; Morlet, M.; Willis, A.; Comparat, V.; Frascaria, R. (Institut de Physique Nucleaire, Orsay, France). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10890 (JUL-Conf-16(Vol.1), pp 70) HIGH SPIN STATES OF ^{191}Au. Gono, Y.; Lieder, R. M.; Mueller-Veggian, M.; Neskakis, A.; Mayer-Boericke, C. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10891 (JUL-Conf-16(Vol.1), pp 71) EXCITATION OF HIGH SPIN STATES IN ^{190,194}Hg. Lieder, R. M.; Beuscher, H.; Davidson, W. F.; Neskakis, A.; Mayer-Boericke, C. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10892 (JUL-Conf-16(Vol.1), pp 72) EVIDENCE FOR THE 1-MEMBER OF THE ODD PARITY BAND IN ^{200}Hg. Schult, O. W. B. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10893 (JUL-Conf-16(Vol.1), pp 73) HIGH SPIN STATES POPULATED BY THE (d,alpha) REACTION ON ^{204}Pb, ^{206}Pb, AND ^{208}Pb AT 80 MeV. Didelez, J. P. (Univ. of Maryland, College Park); Chang, C. C.; Chant, N. S.; Steinberg, R. I.; Wu, J.; Frascaria, N. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23--26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10894 (JUL-Conf-16(Vol.1), pp 74) HIGH SPIN STATES IN Pb ISOTOPES. Bergstroem, I.; Blomqvist, J.; Linden, C. G.; Roulet, C. (Research Inst. for Physics, Stockholm). Jul 1975.

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10895 (JUL-Conf-16(Vol.1), pp 75) E3-TRANSITION RATE BETWEEN THE 11- AND ϵ^+ STATES IN ^{210}Po. Klemt, V. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10896 (JUL-Conf-16(Vol.1), pp 77) COULOMB EXCITATION OF ^{238}U WITH HEAVY IONS AND THE ROTATION VIBRATION COUPLING AT HIGH ANGULAR MOMENTA. Grosse, E.; de Boer, J.; Diamond, R. M.; Stephens, F. S.; Tjoem, P. (Univ. of California, Berkeley). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

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Juelich, 23--26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10897 (JUL-Conf-16(Vol.1), pp 86) LEVEL DENSITY OF GOLD ISOTOPES. Dionisio, J. S. (CNRS, Orsay, France); Vieu, C.; de Wieclawik, W. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10898 (JUL-Conf-16(Vol.1), pp 87) MEASUREMENT AND HYBRID MODEL ANALYSIS OF ^{197}Au(α,xnyp) EXCITATION FUNCTIONS. Djaloeis, A.; Jahn, P.; Probst, H. J.; Mayer-Boericke, C. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10899 (JUL-Conf-16(Vol.1), pp 88) IN BEAM STUDIES OF ^{nat}Ir, ^{197}Au(^{6}Li,xn+yp) REACTIONS INDUCED BY ^{6}Li-IONS OF UP TO 156 MeV. Buschmann, J.; Faust, H.; Klewe-Nebenius, H.; Kropp, J.; Rebel, H.; Schulz, F.; Wisshak, K. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10900 (JUL-Conf-16(Vol.1), pp 108) COMPLETE DETERMINATION OF THE NUCLEAR ALIGNMENT OF THE 8^+ STATE IN ^{216}Ra POPULATED IN THE ^{207}Pb(^{12}C,3 n) REACTION. Nomura, T.; Fukuda, T.; Hiruta, K.; Kutschera, W. (Inst. of Physical and Chemical Research, Wako-shi, Saitama, Japan). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10901 TRANSITION RATES BETWEEN TWO-BODY STATES IN ^{206}Tl, ^{208}Bi, AND ^{210}Bi. Donahue, D.J.; Häusser, O.; Hershberger, R.L.; Lutter, R.; Riess, F. (Sektion Physik der Universität München, München, Germany). Phys. Rev. C 12: No. 5, 1547-1556 (Nov 1975).

Recoil-distance techniques have been used to measure mean lives of some two-hole, particle-hole, and two-particle states in ^{206}Tl, ^{208}Bi, and ^{210}Bi. A comprehensive comparison is presented of these results and all other known $E2$ and $M1$ matrix elements for two-body states with calculations. The calculations are made using wave functions of Ma and True and of Kuo and Herling together with known effective single-particle matrix elements. Reasonable agreement is obtained, particularly with the Kuo-Herling wave functions. From measurements of the $1^- \rightarrow 0^-$ $M1$ transition rate in ^{206}Tl, the magnetic moment of the $3s_{1/2}$ proton-hole state in ^{207}Tl is determined to be $\mu = (1.83 \pm 0.18)\ \mu_N$. (auth)

10902 FOUR-NUCLEON TRANSFER REACTIONS BETWEEN HEAVY IONS BELOW THE COULOMB BARRIER. Hussein, M.S. (Nuclear Physics Laboratory, Oxford, England). Phys. Rev. C 12: No. 5, 1557-1560 (Nov 1975).

The pairing collective model is employed in the description of some aspects of heavy-ion four-nucleon transfer reactions below or at the Coulomb barrier. The "gauge-spin" model of pairing collective motion is utilized for the purpose. (auth)

10903 GAMMA–GAMMA–GAMMA ANGULAR CORRELATION METHOD FOR THE STUDY OF THE CASCADE 589-296-316 keV IN ^{192}Pt. Pande, U. S.; Singh, B. P. (Univ. of Roorkee, India). Indian J. Phys.; 49: No. 5, 350-354(May 1975).

Three NaI(Tl) detectors (spectrometers) mounted in the plane of the table (two detectors are fixed perpendicular to each other and third detector is movable in the opposite quadrant of the two fixed detectors) are used for the coincidence and angular correlation studies for the triple gamma cascade 589 keV → 296 keV → 316 keV in Pt^{192} from the decay of Ir^{192}. The method of triple angular correlation is described and multipolarity of the 296-keV transition is determined. (auth)

10904 SIMULATED CORE POLARIZATION IN THE LEAD REGION. Baldridge, W. J. University Park, PA; Pennsylvania State Univ. (1975). 388p. University Microfilms Order No. 75-22,665.

Thesis (Ph. D.).

Realistic nuclear structure calculations are carried out with a velocity-dependent nucleon-nucleon interaction which has been fit to the nucleon-nucleon scattering data and with many-body corrections included explicitly. This approach is identified here as the "semi-realistic" approach to nuclear structure calculations. First, spectra were computed for several nuclides which differ from ^{208}Pb by two nucleons or holes. These calculations are used to adjust the strength parameters of the multipole forces. Next the fractional parentage method and the two body matrix elements were used to compute matrix elements for nuclei differing from ^{208}Pb by three nucleons or holes. For the ^{208}Pb +- 3 nuclides the spectra, eigenfunctions, electromagnetic transition rates, and moments were determined. For ^{210}Pb, ^{210}Bi, ^{210}Po, ^{209}Bi, and ^{208}Tl the low-lying spectra are in very good agreement with experiment as one would expect since two or three adjustable parameters are available. It was necessary to use a modified Tabakin potential. For the three body nuclei, ^{209}Tl, ^{209}Po, ^{211}Po, ^{211}Pb, ^{211}At, and ^{211}Bi, the agreement with experiment for energy levels was exceptionally good. The $^{7}/_{2}^{-}$ first excited state of ^{211}Bi which has not been previously described correctly in any realistic calculation has been reproduced by the inclusion of the effects of the ^{208}Pb octupole phonon. (Diss. Abstr. Int., B)

10905 FINITE FERMI SYSTEM APPROACH TO VIBRATIONAL NUCLEI. Werner, E. (Institut fuer Theoretische Physik der Technischen, Hanover). pp 199-216 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

Application of the theory of finite Fermi systems (FFS) to vibrational states of closed shell nuclei is discussed where the emphasis is on physical concepts and comparison with other treatments. It is shown that for cases where the microscopic theory of FFS has a sound physical basis (well defined quasi particle states near the Fermi surface) the theory is suitable for the description of low-lying vibrational states. 2 tables, 9 figures. (SDF)

10906 COEXISTENCE AND MIXING OF SPHERICAL AND DEFORMED STATES IN THE REGION OF LIGHTER Hg-ISOTOPES. Dietrich, K. (Technical Univ., Munich). pp 333-343 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

A report is given of recent work on the low energy end of the spectrum of the lightest Hg isotopes with $A \leq 186$, where a competition between states of largely different deformation apparently becomes important. It is shown that certain features of the spectra of the even Hg isotopes may be understood by the coupling between two types of collective excitations: almost harmonic vibrations of a quasi spherical core, and rotational states of a relatively strongly deformed prolate nucleus. 5 figures, 2 tables. (SDF)

10907 HIGH-SPIN STATES IN THE PARTICLE-VIBRATION COUPLING MODEL. Alaga, G. (Univ., Zagreb). pp 344-362 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

The cluster-vibration coupling scheme has proved useful in classifying and describing the properties of low-lying states in vibration-like nuclei. Energy levels, electromagnetic transitions and moments, and amplitudes for transfer reactions are in qualitative and sometimes in quantitative agreement with experiments. The same description is extended to higher-spin states, especially to those in the yrast region. The regularities as well as the irregularities of the yrast bands, as the properties of the low-lying states, are consequences of the interplay of clusters and collective degrees of freedom. 2 figures, 2 tables. (auth)

10908 SINGLE PARTICLE TRANSFER REACTIONS: WHAT CAN THEY TELL US ABOUT VIBRATIONAL STATES. Hering, W. R. (Univ., Munich). pp 408-422 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

Single particle transfer reactions involving nuclei around ^{208}Pb are studied considering only reactions with light ions. Two questions are considered: (1) how can spectroscopic factors be accurately determined experimentally, especially if they are small?, and (2) what can transfer reactions tell about the microscopic structure of collective states? 8 figures. (SDF)

10909 SIMPLE NUCLEAR MODEL. Serber, R. (Columbia Univ., New York). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 700-701(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

By retaining only the essential features of nuclear interactions a nuclear model is constructed simple enough so that its properties can be developed by elementary calculations. The model is very similar to the Fermi–Thomas model of the atom. Nuclear properties of gold are considered. (JFP)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 10734, 10803, 10818, 10869, and 11039.

10910 (INDC(CCP)-63/L) EVALUATING THE CROSS SECTIONS OF THE (n,2n) AND (n,3n) REACTIONS FOR ^{239}Pu. Sukhovitskii, E. Sh.; Kon'shin, V. A. Translated from Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 3, 23-27(1974). 7p. Dep. NTIS (US Sales Only)$4.50.

A nuclear model for calculation of the (n,2n) and (n,3n) neutron cross-sections is proposed. The model uses experimental data on the process of neutron interaction with nuclei. The (n,2n) and (n,3n) cross-sections for both ^{238}U and ^{239}Pu are calculated and the results are compared with those of other evaluations. (auth)

10911 (INIS-mf-1544, pp 27-45) MEASUREMENT OF ABSOLUTE VALUES OF THE U^{235}, Pu^{239}, AND Pu^{241} FISSION CROSS SECTIONS FROM 10 keV TO 2.6 MeV. Szabo, I.; Leroy, J. L.; Marquette, J. P. 1974. (In French).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

This study is a continuation of two series of measurements of the fission cross-sections of U-235, Pu-239 and Pu-241 which were carried out in 1970 to 1971. The energy region was expanded, and new measurements were carried out in the region from 10 keV to 2.6 MeV with the use of the same technique. The results are compared with the results of other laboratories. Renormalization of some of the earlier data is discussed. (tr-auth)

10912 (INIS-mf-1544, pp 46-55) PROMPT NEUTRON SPECTRA OF THE ^{235}U AND ^{239}Pu FISSION. Abramson, D.; Lavelaine, C.; Heriteau, J. P.; Thurzo, A. 1974. (In French).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Measurements were taken of the energy spectra of prompt fission neutrons from U-235 and Pu-239 by means of a system of four detectors. The incident neutron energy was approximately equal to 30 keV. Use was made of a time-of-flight technique and discrimination from the pulse form. The efficiency of the detectors was measured with respect to a standardized "directional detector." The form of the fission neutron spectra is well described by a maxwellian distribution from 0.7 to 5 MeV, whose temperature is equal to 1.30 MeV for U-235 and 1.37 for Pu-239. (tr-auth)

10913 (INIS-mf-1544, pp 145-152) EMISSION OF PROMPT NEUTRONS AND GAMMA RAYS FOLLOWING THE ^{239}Pu FISSION INDUCED BY RESONANCE NEUTRONS. Frehaut, J. (CEA, Paris); Bars, M.; Shackleton, D.; Trochon, J. 1974. (In French).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Measurements of resonance to resonance of the average number of prompt neutrons and the average energy of prompt gamma radiation were measured for ^{239}Pu fission due to neutrons with energies less than 40 eV, using 60-MeV linear accelerator of the Center for Nuclear Studies in Saclay as a pulsed source. The anti-correlating fluctuations were observed for these two parameters. They are assigned to the (n,γ, f) reaction. (tr-auth)

10914 (INIS-mf-1544, pp 153-164) MEASURING MEAN VALUE OF PROMPT NEUTRONS EMITTED IN ^{240}Pu AND ^{235}U FISSION INDUCED BY 1.5 TO 15 MeV NEUTRONS. Frehaut, J.; Soleilhac, M.; Mosinski, G. (CEA, Paris). 1974. (In French).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The Van de Graaf 12-MeV tandem accelerator at the Bruer-le-Watelle Center was used to obtain primary neutrons; and a large liquid scintillator was used for recording fission neutrons. Simultaneously, with a precision of 1.5% (arbitrary units) the average number $\bar{\nu}_p$, of prompt neutrons emitted in ^{240}Pu and ^{235}U fission with 1.5- to 15-MeV neutrons was determined. From the results we were able to determine the fission cross-section of ^{240}Pu relative to that of ^{235}U. Also, the value of $\bar{\nu}_p$ for spontaneous ^{240}Pu fission was determined with good precision.

10915 (INIS-mf-1544, pp 165-176) BACKGROUND VALUES FOR PRECISE DETERMINATION OF $\bar{\nu}_p$ USING A LARGE LIQUID SCINTILLATOR. Frehaut, J. (CEA, Paris). 1974. (In French).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Recent measurements of $\bar{\nu}_p$ for ^{240}Pu were satisfactory because of correct determination of background values. Different background sources are analyzed which are present when a large liquid scintillator is used for precision measurements of $\bar{\nu}_p$ in fissions due to neutrons: background related to an impinging neutron flux; with induced fission, with spontaneous fission, or with false fission. Therefore for decreasing systematic errors it is very important not only to measure the background regularly after each fission but also to use values related to the type of fission observed when correcting the background. (tr-auth)

10916 (INIS-mf-1544, pp 177-186) STUDY OF RESONANCES UNDER FISSION THRESHOLD OF THE ^{239}Pu(d,pf): VARIATION OF A FISSION PROBABILITY DEPENDING UPON FRAGMENT MASSES. Lachkar, J.; Patin, Y.; Sigaud, J. (CEA, Paris). 1974. (In French)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The ^{239}Pu(d,pf) reaction was studied for deuteron energies of 12.5 MeV. The energies of escaping protons and masses of fission fragments were measured and recorded simultaneously. Resonance structures under the fission threshold showed significant variations in relative intensities as a function of the ratio of the fragment masses. They are expressed in the changes of the peak-valley ratio on the curve of fragment mass distribution, in which the average values of light and heavy masses remain constant. The anisotropy of emission of fission fragments was shown to depend on the activation energy of the fissioning nucleus and on the ratio of fragment masses. An interpretation of the effects observed is suggested. (tr-auth)

10917 (INIS-mf-1544, pp 250-255) SEARCHING FOR THE ^{236m}U SPONTANEOUS-FISSIONING ISOMER IN THE ^{235}U(n,γ) REACTION. Zen Chan Bom; Laitai, A.; Omel'yanenko, A. A.; Panteleev, Ts. Ts.; Polikanov, S. M.; Ryabov, Yu. V.; Tyan San Khak. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Experimental results are presented on a search for the spontaneously fissioning isomer ^{236m}U in the reaction ^{235}U(n,γ) in a 60-MeV neutron beam. Delayed coincidences between gamma rays with an energy greater than 0.2 MeV and prompt fission neutrons with energies greater than 0.9 MeV were recorded. The value of 1.5×10^{-4} or less was obtained on the isomer ratio σ_{sp}/σ_f. (tr-auth)

10918 (INIS-mf-1544, pp 256-263) ^{226}Ra SYMMETRICAL AND ASYMMETRICAL FISSION BY NEUTRONS IN THE ENERGY RANGE 5 TO 15 MeV. Zhagrov, E. A.; Kuks, I. M.; Nemilov, Yu. A.; Selitskii, Yu. A.; Funshtein, V. B. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Kinetic energy spectra were measured for fragments formed in fission of ^{226}Ra with monoenergetic neutrons in the energy range 5 to 15 MeV. At low energies of activation of the compound nucleus ^{227}Ra, excluding the possibility of emission fission, the mass yield curve maintained its three-hump nature. At even

lower energies, close to the fission barrier, radium split asymmetrically, as with heavier nuclei. (tr-auth)

10919 (INIS-mf-1544, pp 264-266) ANGULAR DISTRIBUTION AND YIELD OF RADIUM-226 SYMMETRICAL FISSION FRAGMENTS INDUCED BY GAMMA RAYS. Zhagrov, E. A.; Nemilov, Yu. A.; Nikolaev, V. A.; Selitskii, Yu. A. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

By means of glass detectors with filters the yield of fission products from the symmetrical fission of Ra-226 was measured at a limiting photon energy of 15 to 28 MeV. A sharp increase in the symmetrical fission contribution was observed with increasing photon energy. The symmetrical fission contribution was determined at various angles of emission of the fission fragments. (tr-auth)

10920 (INIS-mf-1544, pp 267-269) ANGULAR DISTRIBUTION OF FISSION FRAGMENTS AND SYMMETRICAL FISSION OF ^{226}Ra BY NEUTRONS. Kuks, I. M.; Nikolaev, V. A.; Selitskii, Yu. A.; Funshtein, V. B. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Using glass detectors with filters and semi-conductor detectors, fission of ^{226}Ra by 11- and 14-MeV neutrons was studied. The fraction of fragments which corresponds to the central peak of the mass curve was determined. Results obtained by the two methods agreed well. (tr-auth)

10921 (INIS-mf-1544, pp 270-276) FISSION FRAGMENTS YIELDS AND KINETIC ENERGIES IN THE FISSION OF PLUTONIUM ISOTOPES. Vorob'eva, V. G.; D'yachenko, N. P.; Kuz'minov, B. D.; Sergachev, A. I.; Surin, V. N. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The yield and kinetic energies of fission fragments from ^{241}Pu and ^{242}Pu with 1- to 3.5-MeV neutrons and from spontaneous fission of ^{242}Pu were studied. Average kinetic energies for five isotopes of plutonium (238-242) were compared. Questions related to the mechanism of the descent of the nucleus from the saddle point to the rupture point and to natural kinetic energy of fission fragments are discussed. (tr-auth)

10922 (INIS-mf-1544, pp 277-282) FINE STRUCTURE OF ENERGY SPECTRA OF THE ^{252}Cf SPONTANEOUS FISSION FRAGMENTS. Baranov, I. A.; Tutin, G. A. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The fine structure of the energy distribution of fragments from spontaneous fission of ^{252}Cf was studied experimentally. The existence of such a structure in recording the energy of light fragments at very high values (116.5-124 MeV) was shown statistically reliable. The structure has a periodicity of about 5 atomic units. (tr-auth)

10923 (INIS-mf-1544, pp 283-290) THREE-PARAMETRICAL MEASUREMENTS OF MASS CORRELATIONS, KINETIC ENERGIES AND CHARGES OF FISSION FRAGMENTS AT THE ^{252}Cf SPONTANEOUS FISSION. Donichkin, A. G.; Solov'ev, S. M.; Ehismont, V. P. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The kinetic energies of both fragments and the energy of the quanta of the K series of characteristic radiation emitted by the fragments were determined in each fission act. A strong dependence of Z_0 on mass and kinetic energy of all fragments was shown, but there was a relatively weak relation of charge to kinetic energy for a given mass. The results are compared with data from other published work. (tr-auth)

10924 (INIS-mf-1544, pp 291-297) NUCLEON PAIRING AND FISSION X-RAY SPECTRA. Donichkin, A. G.; Solov'ev, S. M.; Ehismont, V. P. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Strong effects were observed in the evenness of the number of nucleons (protons) in charge yields, times of emission and relative intensity of x rays. The yield of elements with an even charge increases with an increase in kinetic energy of the fission fragments (with a decrease in excitation energy). The time of emission of x rays by fission fragments having charges Z = 54 and 56 is lower than the time of emission for neighboring odd-charged elements. Lines of even elements stand out significantly in the x-ray spectra of fission products. All these facts are discussed and analyzed from the point of view of possible approaches to estimating the magnitude of the paired energy in neutron-excess nuclei. (tr-auth)

10925 (INIS-mf-1544, pp 298-305) ^{239}Pu and ^{242m}Am TERNARY FISSION BY NEUTRONS. Vorob'ev, A. A.; Grachev, V. T.; Kondurov, I. A.; Miroshnichenko, Yu. A.; Nikitin, A. M.; Seliverstov, D. M.; Smirnov, N. N. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Using a mass spectrometer, identifying particles according to energy, time of flight, specific ionization, and magnetic rigidity, the energy spectra and yield of light nuclei ($Z \leq 8$) formed in fission of ^{239}Pu and ^{242m}Am by neutrons with a reactor spectrum were determined. For the fission of ^{239}Pu, the upper limits of the probability of formation of fragments with M = 20 to 60 were determined. (tr-auth)

10926 (INIS-mf-1544, pp 306-314) ANGULAR AND ENERGY DISTRIBUTIONS OF LIGHT PARTICLES PRODUCED IN ^{252}Cf SPONTANEOUS FISSION. Polar Emission of Light Particles. Adamov, V. M.; Drapchinskii, L. V.; Kovalenko, S. S.; Petrzhak, K. A.; Pleskachevskii, L. A.; Tyutyugin, I. I. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

An experimental study is presented of the yields of quasi-stable nuclei of the type ^{4}H, ^{5}He, and ^{6}He formed in ^{252}Cf fission. The study was made by the method of determining the asymmetry in the number of neutrons emitted "for" and "against" the direction of movement of light particles. Yields of protons, tritons, and alpha particles emitted at different angles relative to the direction of movement of the fragments were studied. Measurements were made of the energy distribution of light particles at different angles of emission relative to the direction of movement of the fragments. (tr-auth)

10927 (INIS-mf-1544, pp 315-322) DETERMINATION OF SOME FISSION FRAGMENTS YIELD FROM U-238 FISSION BY REACTOR SPECTRUM NEUTRONS. Yurova, L. N.; Bushuev, A. V.; Kozhin, A. F. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The probability of formation of different products in the fission of ^{238}U by neutrons from the IRT-2000 reactor was determined. The gamma spectra of the fission products were measured with a Ge-Li spectrometer. The absolute yields of ^{238}U fission products were calculated from yield values corresponding to the products formed in fission of ^{235}U by thermal neutrons from the same reactor. The number of fissions in samples was determined from the intensity of the radiation of the fragment indicator ^{140}La. The results generally agreed with data of other authors. (tr-auth)

10928 (INIS-mf-1544, pp 323-328) APPLICATION OF GeLi DETECTOR TO THE MEASUREMENT OF U-238 FISSION YIELDS FOR 14.4 MeV NEUTRONS. Daroczy, S. (Kossuth Lajos Tudomanyegyetem, Debrecen, Hungary); Raics, P.; Nagy, S.; Scikai, J.; German, E. 1974.

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po

Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

With small fission cross-sections and neutron fluxes, measurements made with Ge-Li detectors of the direct gamma spectra from irradiated thick targets without the use of radiochemical analysis or nuclear recoil apparently are the most suitable for determining fragment yields. This "direct Ge-Li" method was used for measuring the yield of 17 fragments formed in the fission of ^{238}U by 14.4-MeV neutrons. The results agree well with radiochemical data. The precision of determination of the yields depends strongly on the error in the intensity of the characteristic γ lines of the fragments. (tr-auth)

10929 (INIS-mf-1698, pp 13-17) MEASUREMENT OF THE ^{238}U FISSION CROSS SECTION BY 14.6 MeV NEUTRONS. Alkhazov, I. D.; Kasatkin, V. P.; Kostochkin, O. I.; Malkin, L. Z.; Sorokina, A. V.; Petrzhak, K. A.; Fomichev, A. V.; Shpakov, V. I.; Rumyantsev, B. V.; Sokolov, A. M. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A presentation is made of measurements of the fission cross-section of ^{238}U by 14.6 MeV neutrons with the use of the method of accompanying particles. The neutrons were obtained on a low-voltage neutron generator according to the reaction H-3(d,n)He-4. During the measurements the coincidences were counted between the fission products and the accompanying alpha particles. Fission fragments were counted by combined, ionization and gaseous, scintillation chambers; the alpha particles were counted by a plastic scintillator. The fission cross-section obtained in this study was 1.17 ± 0.01 barns. (tr-auth)

10930 (INIS-mf-1698, pp 21-25) U^{235} AND ^{238}U FISSION CROSS SECTIONS BY ^{252}Cf SPONTANEOUS FISSION NEUTRONS. Adamov, V. M.; Drapchinskii, L. V.; Kovalenko, S. S.; Petrzhak, K. A.; Pleskachevskii, L. A.; Sokolov, A. M. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Fission cross-section were measured for a series of uranium isotopes by neutrons originating from the spontaneous fission of ^{252}Cf. Layers of uranium and ^{252}Cf were placed on opposite sides of a metal backing. By means of two ionization chambers a simultaneous count was taken of fission products from the spontaneous fission of ^{252}Cf and the induced fission of uranium in coincidence (τ = 50 nsec). The accuracy of measuring the fission cross-sections is ~2%. (tr-auth)

10931 (INIS-mf-1698, pp 26-41) RESEARCH AT CBNM TO IMPROVE THE ACCURACY OF NEUTRON STANDARD CROSS SECTIONS. Deruytter, A. J. 1974.

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Increasing the precision of cross-sections which may be used as standards in the determination of other cross-sections is important. Therefore at the Central Office of Nuclear Measurements, σ_α and σ_f values were studied for ^{235}U and ^{239}Pu and were determined for E = 0.0253 eV with a precision of 0.5% and at resonance energies, with a precision of 1%. (tr-auth)

10932 (INIS-mf-1698, pp 49-56) MEASUREMENT OF CAPTURE-TO-FISSION RATIO FOR PLUTONIUM-239 IN THE ENERGY RANGE 0.1 TO 30 keV. Bolotskii, V. P.; Petrushin, V. I.; Soldatov, A. N.; Sukhoruchkin, S. I. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The purpose of this work was greater precision in the energy dependence of ^{239}Pu alpha values. Measurements were made on the JINR time-of-flight spectrometer with a resolution of 15 msec/meter. The effects of fission and capture were measured with 8 detectors having stilbene crystals. Gamma and fast neutron pulses were separated by an electronic scheme. The results confirmed the existence of a previously observed structure in the alpha values in the energy region above 0.1 keV. (tr-auth)

10933 (INIS-mf-1698, pp 70-75) MEASUREMENT OF MEAN VALUE OF 0.01 TO 40 eV SECONDARY NEUTRONS FOR PLUTONIUM-239. Bolotskii, V. P.; Ignat'ev, K. G.; Borovlev, S. P.; Polozov, M. V.; Sukhoruchkin, S. I. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The relative dependence of the value of $\bar{\nu}$ on neutron energy in the interval from 0.01 to 40 eV for ^{239}Pu was determined. On the average the value of $\bar{\nu}$ may be considered constant with a precision up to 1%. (tr-auth)

10934 (INIS-mf-1698, pp 76-82) DETERMINATION OF NEUTRON MEAN VALUE FOR THE ^{252}Cf FISSION EVENT. Aleksandrov, B. M.; Belov, L. M.; Kramarovskii, Ya. M.; Petrzhak, K. A.; Prusakov, A. G.; Shlyamin, E. A. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

This study presents the results of measuring the average number of neutrons $\bar{\nu}$ from ^{252}Cf by a method of separately determining the neutron yield of the target and the fission count rate in the target. The error of determining the neutron yield, which was measured by three methods, is 0.8%. A silicon detector is used to detect the fission products. The error of determining the fission count rate in the target is 1%. The measured value of the average number of neutrons $\bar{\nu}$ is equal to 3.770 ± 0.045 (1.3%) for ^{252}Cf. (tr-auth)

10935 (INIS-mf-1698, pp 83-113) PROMPT NEUTRON YIELD FROM THE SPONTANEOUS FISSION OF ^{252}Cf. Boldeman, J. W. 1974.

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Measurements of $\bar{\nu}_p$ for ^{252}Cf were made by a liquid-scintillator method. The average number of prompt neutrons ($\bar{\nu}_p$) for spontaneous fission of ^{252}Cf was found to be 3.735 ± 0.014. Corrections and contributions to experimental uncertainty are considered. (tr-auth)

10936 (INIS-mf-1698, pp 114-120) RECENT RELATIVE $\bar{\nu}$ MEASUREMENTS. Boldeman, J. W. 1974.

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Measurements were made of the values of $\bar{\nu}_p$ for ^{244}Cm and ^{246}Cm relative to $\bar{\nu}_p$ = 3.724 for ^{252}Cf using a large liquid scintillator. Previous measurements of $\bar{\nu}_p$ for ^{240}Pu and ^{242}Pu relative to ^{252}Cf were re-examined. (tr-auth)

10937 (INIS-mf-1698, pp 121-129) ENERGY DEPENDENCE OF THE AVERAGE TOTAL FISSION FRAGMENT KINETIC ENERGY IN THE NEUTRON FISSION OF ^{233}U. Boldeman, J. W.; Walsh, R. L. 1974.

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The average kinetic energy, $\overline{E}_k$, of the fragments formed in fission of ^{233}U by monoenergetic neutrons with energies below 1 MeV was measured. An increase of $\overline{E}_k$ was obtained at about 400 keV with increase in neutron energy from thermal to 150 keV. (tr-auth)

10938 (INIS-mf-1698, pp 130-137) MEASUREMENTS OF $\bar{\nu}$ VALUES FOR SOME THORIUM, URANIUM, AND PLUTONIUM ISOTOPES. Conde, H.; Holmberg, M. 1974.

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A short description is given of $\bar{\nu}$ measurements made in the Scientific Research Institute of National Defense for the isotopes of thorium, uranium, and plutonium. Experiments included absolute measurement of $\bar{\nu}$ values for spontaneous fission of ^{252}Cf and measurements of the energy dependence of $\bar{\nu}$ for ^{232}Th, ^{235}U, ^{236}U, ^{238}U, ^{239}Pu, and ^{241}Pu. Results are also presented of $\bar{\nu}$ measurements for spontaneous fission of ^{236}U, ^{238}U, and ^{240}Pu. (tr-auth)

10939 (INIS-mf-1698, pp 138-142) ^{252}Cf FISSION NEUTRON SPECTRA. Blinov, M. V.; Vitenko, V. A.; Kazarinov, N. M.; Krisyuk, I. T.; Tuz, V. T. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The neutron spectrum of ^{252}Cf in spontaneous fission was measured in the range from 20 to 200 keV by a time-of-flight method using a ^{6}Li(Eu) neutron detector and gas scintillation counter for the fragments. (tr-auth)

10940 (INIS-mf-1698, pp 143-154) FINE STRUCTURE IN NEUTRON SPECTRA OF THE ^{252}Cf SPONTANEOUS FISSION. Averchenkov, V. Ya.; Nefedov, Yu. Ya.; Khilkov, Yu. V. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The results of measurements of the neutron spectrum of spontaneously fissioning ^{252}Cf by a time-of-flight method are presented. Fourteen monoenergetic groups of neutrons were observed in the fission neutron spectrum in the energy range from 0.04 to 6 MeV. The total yield of these groups was around 4% of the total number of fission neutrons. (tr-auth)

10941 (INIS-mf-1698, pp 171-176) ANGULAR CORRELATIONS OF ^{252}Cf FISSION NEUTRONS. Blinov, M. V.; Vitenko, V. A.; Krisyuk, I. T. 1974. (In Russian)

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A method is described for studying angular correlations for ^{252}Cf fission neutrons. The results of the first stage of the work are presented. Correlation was observed only for angles from 60° to 90°. (tr-auth)

10942 (JUL-Conf-16(Vol.1), pp 24) HADRONIC EXCITATION OF THE GIANT RESONANCE REGION OF ^{208}Pb. Halbert, E. C. (Oak Ridge National Lab., TN); McGrory, J. B.; Satchler, G. R.; Speth, J. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23--26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10943 (JUL-Conf-16(Vol.1), pp 25) GIANT MULTIPOLE RESONANCE IN ^{208}Pb. Grecksch, E.; Knuepfer, W.; Huber, M. G. (Univ. of Erlangen, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10944 (KFK-2191) MEASUREMENTS OF THE RATIO OF ^{235}U CROSS SECTIONS FOR CAPTURE AND FISSION IN THE NEUTRON ENERGY RANGE FROM 200 eV TO 20 keV. Yen, C. S. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Sep 1975. 81p. (In German). Dep. NTIS (US Sales Only) $6.00.

Thesis. Submitted to Karlsruhe Univ. (F. R. Germany). Fakultaet fuer Maschinenbau.

The ratio of ^{235}U cross sections for capture and fission, α, has been measured in the neutron energy range from 200 eV to 20 keV with the slowing-down-time spectrometer. A gamma proportional counter surrounded by the cylindrical ^{235}U samples was used to determine the sum of capture and fission events. The fission rate alone has been measured with a fission chamber. A careful calibration of the counters has been carried out at the thermal column of the STARK-reactor. The measured α-values of ^{235}U have an error between 13% and 20%. Due to the error propagation, about 80% of the total error results from inaccuracies in the calibration factors. (20 figures, 8 tables) (auth)

10945 EFFECTS OF ROTATION ON THE STABILITY OF NUCLEI UNDER FISSION AND THE POSSIBILITY OF FUSION IN HEAVY-ION REACTIONS. Mustafa, M.G. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742); Kumar, K. Phys. Rev. C 12: No. 5, 1638-1646 (Nov 1975).

The two-center shell model for fission is extended to include the effects of nuclear rotation or angular momentum J. The principle of minimization of total nuclear energy with respect to a constraint on J leads to an effective potential energy which depends on J as well as moment of inertia. This effective potential energy is minimized with respect to nuclear shape variables, neutron pairing energy gap, and proton pairing energy gap for each J value. The resulting potential minima, fission barriers, and moments of inertia are quite sensitive to J. Results are given for $^{208}_{82}$Pb, $^{240}_{94}$Pu, and for a super-heavy nucleus $^{298}_{114}$X. Our microscopic calculations of the critical angular momentum (at which the fission barrier vanishes) are compared with the rotating liquid drop calculations of Cohen, Plasil, and Swiatecki. The influence of these results on the possibility of fusion in heavy-ion reactions is discussed. (auth)

10946 DETERMINATION OF THE ^{237}Np$(n,2n)^{236}$Np CROSS SECTION AT 15 MeV NEUTRON ENERGY. Lindeke, K.; Specht, S.; Born, H. (Institut für Radiochemie der Technischen Universität München, D-8046 Garching, Germany). Phys. Rev. C 12: No. 5, 1507-1510 (Nov 1975).

The neutron cross section for the ^{237}Np$(n,2n)^{236}$Np^{g} reaction has been determined at a neutron energy of 15 MeV. Two independent methods were used: (1) α particles of ^{236}Pu following the β^{-} decay of ^{236}Np were counted after chemical separation of Pu. (2) The 642.4 keV γ rays of ^{236}Np^{g} decay to ^{236}U were measured directly after the irradiation of the ^{237}Np sample. The neutron fluence was calculated from the ^{27}Al$(n,\alpha)^{24}$Na reaction and from the measurement of the fission product ^{97}Zr with a calibrated Ge(Li) spectrometer. The most precise value is 247 ± 22 mb. The error is mainly due to uncertainties of the nuclear data used for the cross-section calculation. (auth)

10947 DISTRIBUTION OF MASS IN THERMAL-NEUTRON-INDUCED FISSION OF ^{257}Fm. Flynn, K.F.; Gindler, J.E.; Glendenin, L.E. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. C 12: No. 5, 1478-1482 (Nov 1975).

Fission yields were measured radiochemically for mass chains 112, 127, 132, and 140 in thermal-neutron-induced fission of ^{257}Fm. These yields indicate a single-peaked (symmetric) mass distribution. Comparison is made with the distribution deduced from kinetic-energy measurements, and the effects of neutron emission from the fission fragments are considered. (auth)

10948 EVIDENCE FOR TWO-NUCLEON POLARIZATION IN THE $\pi(h_{9/2}i_{13/2})_{11^-}\nu(j^{-2})^{0}_{0^+}$ LEVEL IN ^{208}Po. Wikstroem, K. (Forskningsenstituut foer Atomfysik, Stockholm); Bergstroem, I.; Blomqvist, J.; Herrlander, C. J.; Fant, B.; Rankonen, V. Phys. Scr.; 10: No. 6, 292-296(Dec 1974).

From in-beam gamma-ray spectroscopy measurements on the ^{208}Pb$(\alpha,4n)^{208}$Po reaction using the Stockholm 225-cm cyclotron, it is concluded that there is an 11^{-}, 8 ns isomeric state in ^{208}Po, which lies 1 175 keV above the $\pi(h^{2}_{9/2})8^{+}$ state and that this isomeric state should have the configuration $\pi(h_{9/2}i_{13/2})_{11^-}\nu(j^{-2})0^{+}$. Calculations based on the use of empirical two-particle interactions give a position of the 11^{-} level which deviates by about +100 keV from the experimentally found position. It is suggested that this deviation is mainly due to the difference in the polarization of the ^{206}Pb- and ^{208}Pb-cores by the two aligned $h_{9/2}$ and $i_{13/2}$ protons. (auth)

10949 YIELDS OF SOME RUTHENIUM AND RHODIUM ISOTOPES IN THE SPONTANEOUS FISSION OF ^{252}Cf. Goektuerk, H.; Birguel, O.; Erten, H. N.; Aras, N. K. (Middle East Technical Univ., Ankara). J. Inorg. Nucl. Chem.; 37: No. 11, 2247-2248(Nov 1975).

Cumulative yields of ruthenium and rhodium isotopes in the mass-chains A = 105, 107, and 108 for the spontaneous fission of ^{252}Cf have been determined using radiochemical techniques and γ-ray spectroscopy. Chain yields for these masses are found as 5.2 ± 0.4, 6.3 ± 0.7 and 6.0 ± 0.9 respectively. The results indicate that the light peak in mass-yield distribution may be narrower than previously reported. (auth)

10950 DISTRIBUTION OF FISSION YIELDS IN THE 3.0 MeV NEUTRON-INDUCED FISSION OF ^{238}U. Harvey, J. T.; Adams, D. E.; James, W. D.; Beck, J. N.; Meason, J. L.; Kuroda, P. K. (Univ. of Arkansas, Fayetteville). J. Inorg. Nucl. Chem.; 37: No. 11, 2243-2246(Nov 1975).

The mass yield distribution for the 3.0 MeV neutron-induced fission of ^{238}U has been measured radiochemically for 32 mass chains in the region A = 83 to 151. Gross beta counting was used to determine the absolute activities of each nuclide measured, with cumulative fission yields measured relative to ^{140}Ba. This work shows some disagreement with the previously reported mass yields for 3.0 MeV neutron-induced fission of ^{238}U. Ten yields are presented that have been experimentally measured for the first time. The yields measured make up approx. 110% of the total 200% expected from fission. Fine structure was observed to exist at mass number 134. (auth)

10951 IDENTIFICATION OF SHORT-LIVED NEUTRON-RICH RUTHENIUM AND RHODIUM ISOTOPES IN FISSION. Franz, G.; Herrmann, G. (Univ., Mainz). J. Inorg. Nucl. Chem.; 11: No. 12, 857-863(Dec 1975).

Short-lived ruthenium and rhodium isotopes (^{107}Ru, ^{108}Ru, ^{108}Rh, ^{109}Ru, ^{109}Rh, ^{110}Ru, ^{110}Rh, ^{111}Ru, ^{111}Rh, ^{112}Ru, ^{112}Rh, ^{113}Ru) have been separated from fission products by a rapid chemical procedure and identified by means of γ-ray spectroscopy. Nuclides with half-lives down to 3 sec were accessible. Ruthenium isotopes up to mass number 113 have been identified. (auth)

10952 EVIDENCE FOR A CORE-EXCITED ISOMERIC $3^1/_2^-$ STATE IN ^{209}Po. Bergstroem, I.; Blomqvist, J.; Herrlander, C. J.; Wikstroem, K.; Fant, B. (Forskingsinstitut foer Atomfysik, Stockholm). Phys. Scr.; 10: No. 6, 287-291(Dec 1974).

Using alpha particles from the Stockholm 225-cm cyclotron, gamma rays from the ^{208}Pb(α,3n) reaction have been studied. Excitation functions, angular distributions, prompt and delayed gamma rays and gamma-gamma coincidences were measured. The results give strong evidence for a $3^1/_2^-$ isomeric state in $^{209}_{84}Po_{125}$ with a half-life of 118 ± 3 ns, which is interpreted as being mainly due to the core-excited $\pi h_{9/2}\pi i_{13/2}\nu g_{9/2}(\nu^{-2})0^+$ configuration. (auth)

10953 ENERGY LEVEL STRUCTURE OF ^{203}Tl AND ^{205}Tl FROM THE (n,n'gamma) REACTION. Cottles, V. M. New Orleans; Tulane Univ. (1975). 150p. University Microfilms Order No. 75-23,271.

Thesis (Ph. D.).

The (n,n'gamma) reaction was used to investigate excited levels in the nuclei ^{203}Tl and ^{205}Tl. Neutrons with energies from 0.1 to 2.2 MeV were scattered from /sup nat/Tl and $^{205}Tl_2O_3$ samples, and the deexcitation gamma-ray production thresholds and cross sections were measured. The gamma-ray transitions were assigned to their respective isotopes on the basis of threshold techniques, prior knowledge of the location of some excited levels, and the results of experiments performed on the isotopically enriched ^{205}Tl scatterer. Eighteen transitions are assigned to eleven excited levels in ^{203}Tl, and twenty-four transitions are assigned to thirteen excited levels in ^{205}Tl. The angular distributions of the more intense gamma rays were measured. The measured alpha$_2$ and alpha$_4$ coefficients for the distributions were compared to the predictions of a Hauser–Feshbach analysis which allowed the assignment of J/sup pi/ values to excited levels in ^{203}Tl and ^{205}Tl. (Diss. Abstr. Int., B)

10954 THE CORIOLIS-COUPLED BANDS IN ^{231}Pa AND THE DECAY OF ^{231}Th. Hornshoej, P.; Tidemand-Petersson, P. (Aarhus Univ. (Denmark)); Kaczarowski, R.; Kotlinska, B. (Institute of Nuclear Research, Warsaw (Poland)); Zylicz, J. (Warsaw Univ. (Poland). Instytut Fizyki Doswiadczalnej). Nucl. Phys., A; 248: No. 3, 406-428(1 Sep 1975).

A re-investigation of the ^{231}Th decay scheme has been performed with magnetic and semiconductor spectrometers. The Q-value of the decay was determined to be Q_β = 389 ± 2 keV. For ^{231}Pa the measurements suggest spins and parities of $^3/_2^+$, $^3/_2^-$, and $^5/_2^-$ for the 318.0, 320.2, and 351.8 keV levels, respectively. Half-lives of 274 ± 10 ps and 45.1 ± 1.3 ns were found for the 58.6 keV ($^7/_2^-$) and the 84.2 keV ($^5/_2^+$) levels. Calculations, in which the Nilsson model was extended to include Coriolis coupling of the $i_{13/2}$ orbitals and two N = 4 orbitals, successfully explain the peculiar structure of the positive-parity rotational bands in ^{231}Pa. From these calculations and from the value of the ground state quadrupole moment, derived from the rotational transition probability B(E2, 58.6 keV), the deformation parameters were determined to be (ϵ_2, ϵ_4) = (0.164, −0.100). (NL)

10955 NEUTRON FLUX MEASUREMENTS WITH THIN URANIUM DIOXIDE FILMS. Feintuch, K. D. (Singer Simulation Products, Silver Spring, MD). pp 28-30 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).

From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

Nuclear Theory

Refer also to abstracts 10415, 10438, 10453, 10532, 10569, 10665, 10841, 10905, and 10910.

10956 (COO-1265-170, pp 44-55) USE OF $\alpha + \alpha$ SCATTERING AS A SELECTIVE PROBE OF THE NUCLEON–NUCLEON INTERACTION. Brown, R. E. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10957 (COO-1265-170, pp 135-140) SUB-COULOMB NEUTRON TRANSFER CALCULATIONS. Franey, M. A.; Lilley, J. S. Sep 1975.

In John H. Williams Laboratory of Nuclear Physics, University of Minnesota, annual report, 1975. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics).

10958 (HMI-B-169) INTERFERENCE IN DIRECT HEAVY ION REACTIONS. von Oertzen, W. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F.R. Germany). Bereich Kern- und Strahlenphysik). Apr 1975. 50p. (CONF-750357-1). Dep. NTIS (US Sales Only) $5.50.

From 4th INS lecture on nuclear physics; Izy Peninsula, Japan (Mar 1975).

Using the superposition principle the interference of different branches is discussed in scattering and reaction processes. In elastic and inelastic scattering different phase rules result, depending on the fact if the coherent contributions arise at the same or different "sides" of the target nucleus. In transfer processes there can be two (or more) coherent contributions, which are interrelated by antisymmetrisation. The scattering of identical nuclei, nearly identical nuclei (elastic transfer) and reactions in which identical nuclei (or nearly identical nuclei) as well as isospin multiplet members are produced are discussed. Phase rules with respect to the behaviour of angular distributions at 90° cm and their dependence on the properties of the reaction process are obtained which are similar to those found in scattering processes. It is found that with the application of the generalized Pauli principle for composite objects the reaction mechanism has to be considered. (25 figures) (auth)

10959 (IN-2P3-CF-74-1, pp I-27 (Pt.1A)) DWBA APPLICATION TO HEAVY IONS. Roynette, J.-C. [nd]. (In French).

From scientific meeting of the Tandem accelerators users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

Different ways to reduce the multidimensional integral of the DWBA amplitude for the heavy ion transfer reaction case, are compared. An approximation taking into account the recoil effect and inelastic excitations is presented. Results of a full finite range calculation for the one-nucleon-transfer reaction are also presented. (FR)

10960 (IN-2P3-CF-74-1, pp 1-4(Pt.5A)) GIANT RESONANCES. Zuker, A. P. [nd]. (In French).

From scientific meeting of the Tandem accelerators users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

The giant multipolar resonance and the coupling between this resonance and the weak energy levels of nuclei are explained. (FR)

10961 (IN-2P3-CF-74-1, pp 1-22(Pt.8A)) DETERMINATION OF NUCLEAR MOMENTS IN EXPERIMENTS ON CHARGED PARTICLE BEAMS. Hrynkiewicz, A. Z. [nd].

From scientific meeting of the Tandem accelerators users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

Nuclear magnetic moment measurements by the in-beam perturbed angular correlation method are discussed, with special emphasis on the use of transient fields. Measurements on states in several sd and d^n nuclei are reported. (FR)

10962 (IN-2P3-CF-74-1, pp 1-6(Pt.1B)) QUANTITATIVE ANALYSIS OF MULTI-NUCLEON TRANSFERS INDUCED BY HEAVY IONS. Volant, C. [nd]. (In French).

From scientific meeting of the Tandem accelerators users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

Direct multi-nucleon transfer reactions are analyzed in the framework of the DWBA. The multi-nucleon transfer was examined in the case where the leading process was the compound nucleus formation and the spectroscopic results obtained from an analysis using the Hauser–Feshbach statistical model. (FR)

10963 (IN-2P3-CF-74-1, pp 1-9 (Pt.2B)) SEMI-CLASSICAL ASPECT OF A NUCLEON TRANSFER SELECTIVITY BETWEEN HEAVY IONS. Pougheon, R. [nd]. (In French).

From scientific meeting of the Tandem accelerators users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

The semi-classical description is used to select cases in which ejectile excitation should be enhanced and to predict cases in which two-step process is expected in heavy-ion induced transfer reactions. Experimental evidence of these cases is described. (FR)

10964 (INIS-mf-1544, pp 71-74) DESCRIPTION OF FAST NEUTRON ELASTIC AND NONELASTIC CROSS SECTIONS BY A SEMICLASSICAL OPTICAL MODEL. Angeli, I.; Csikai, J. (Kossuth Lajos Tudomanyegyetem, Debrecen, Hungary). 1974.

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 3. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The applicability of a semiclassical optical model is discussed in describing the elastic and nonelastic scattering cross-sections of fast neutrons. (tr-auth)

10965 (INIS-mf-1784) IMPORTANCE OF FINITE CHANNEL WIDTH IN SPECTRAL ANALYSIS. Ponczek, R. L. I. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil). Instituto de Fisica). Jan 1974. 91p. (In Portuguese). INIS.

Experimental data are often obtained in the form of a histogram, where a range of values of the independent variable are combined into one data point. The parameters of an assumed function are then adjusted to fit these data points, usually ignoring the fact that the points correspond to intervals of finite width rather than specific values of the independent variable. In this work the values of the parameters for various functions are determined taking into account the histogram nature of the data. Results are compared with the usual method of data fitting and the significance of the differences is discussed. For each function and predetermined set of parameters a spectrum was simulated using a random number generator. The spectrum was then least squares fitted to the function by the traditional method and also taking into account the width effect. Parameters obtained by both methods are compared with the original parameters used to simulate the spectrum. The histogram method proved superior in cases where the width of the interval became large in terms of variation of the function. The method was also applied to Fourier analysis of spectra. The Fourier coefficients of a function can be altered by the width effect and some can be cancelled completely in the traditional treatment. (INIS)

10966 (IPNO-1974, pp T1-T52) THEORETICAL PHYSICS DIVISION. [nd]. (In French).

In annual report 1974.

This report is a survey of the studies done in the Theoretical Physics Division of the Nuclear Physics Institute; the subjects studied in theoretical nuclear physics were the few-nucleon problem, nuclear structure, nuclear reactions, weak interactions, intermediate energy and high energy physics. In this last field, the subjects studied were field theory, group theory, symmetry and strong interactions. (FR)

10967 (JINR-E2-9138) HEAVY ION INTERACTIONS AT HIGH ENERGIES. Baldin, A. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 32p. (CONF-750631-14). Dep. NTIS (US Sales Only) $5.00.

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975).

Results of research carried out at JINR, Dubna are reviewed. Special attention is given to single-particle inclusive processes, which occur when relativistic nuclei interact, since more complicated processes are not studied well enough at present. In addition, a short review is given of the program of research with relativistic nuclei at the Laboratory of High Energies, JINR. (14 figures) (auth)

10968 (JINR-R9-7339, pp 9-21) STUDY ON NUCLEAR STRUCTURE. Solov'ev, V. G. (Joint Inst. for Nuclear Research, Dubna, USSR). 1973. (In Russian)

From 3rd symposium on the isochronous cyclotron U-120M and its uses for studies on nuclear physics; Ceske Budejovice, Czechoslovakia (14 May 1973). (Joint Inst. for Nuclear Research, Dubna (USSR)).

Basic problems related to the study of atomic nuclear structure are considered, viz., the role of nuclear reactions in this study, expansion of the field of nuclei studied, and explanation of the fine structure of giant resonance. The general requirements for experimental equipment needed in the study of nuclear structure and the mechanism of nuclear reactions are formulated. (INIS)

10969 (JINR-R9-7339, pp 224-232) SOME PHYSICAL EXPERIMENTS ON PARTICLE BEAMS WITH A HIGH ENERGY RESOLUTION. Polikanov, S. M. (Joint Inst. for Nuclear Research, Dubna, USSR). 1973. (In Russian)

From 3rd symposium on the isochronous cyclotron U-120M and its uses for studies on nuclear physics; Ceske Budejovice, Czechoslovakia (14 May 1973). (Joint Inst. for Nuclear Research, Dubna (USSR)).

Results of experiments on nuclear isomers, obtained using electrostatic tandem generators, are presented. The possibilities are considered of using the U-120M isochronous cyclotron for searching for new spontaneously fissioning isomers, measuring reaction thresholds, and studying vibration resonance in the second potential well. (INIS)

10970 (JUL-Conf-16(Vol.1), pp 3) GIANT RESONANCE EFFECTS AND THE ENERGY WEIGHTED SUM RULE. von Geramb, H. V. (Inst. fuer Kernphysik, Juelich, Ger.); Amos, K. A. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10971 (JUL-Conf-16(Vol.1), pp 15) COLLECTIVE VIBRATION EXCITATION AND PARTICLE MISSION FOLLOWING THE NUCLEAR MUON CAPTURE. Kozlowski, T.; Zglinski, A. (Inst. of Nuclear Research, Swierk, Poland). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10972 (JUL-Conf-16(Vol.1), pp 26) SELF-CONSISTENT DESCRIPTION OF BREATHING MODES IN SPHERICAL NUCLEI WITH THE GENERATOR COORDINATE METHOD. Krewald, S.; Galonska, J. E.; Rosenfelder, R.; Faessler, A. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10973 (JUL-Conf-16(Vol.1), pp 27) LARGE AMPLITUDE COLLECTIVE MOTION AND DENSITY DEPENDENT INTERACTIONS. Brink, D. M. (Dept. of Theoretical Physics, Oxford); Engel, Y. M.; Goeke, K.; Krieger, S. J.; Vautherin, D. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10974 (JUL-Conf-16(Vol.1), pp 28) SELF-CONSISTENT RPA-CALCULATIONS USING A SKYRME INTERACTION. Krewald, S.; Klemt, V.; Faessler, A.; Speth, J. (Int. fuer Kernphysik, Juelich, Ger.). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10975 (JUL-Conf-16(Vol.1), pp 30) VALIDITY OF SEVERAL MANY-BODY METHODS IN THE BACKBENDING REGION. Ring, P.; Chu, S. Y.; Marshalek, E. R. (Univ. of California, Berkeley). Jul 1975.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23--26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik).

10976 (JUL-Conf-16(Vol.1), pp 31) BOSON SHELL-MODEL OF VIBRATIONAL NUCLEI. Arima, A. (Univ. of Tokyo); Iachello, F. Jul 1975.

From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).

In international symposium on highly excited states in nuclei, Juelich, 23-26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10977 (JUL-Conf-16(Vol.1), pp 33) CONCERNING THE HIGH SPIN PREDICTIONS FROM HFB THEORY. Hilton, R. R. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10978 (JUL-Conf-16(Vol.1), pp 49) ASYMMETRIC ROTOR MODEL FOR HIGH SPIN STATES IN TRANSITIONAL ODD-MASS NUCLEI. Toki, H.; Faessler, A. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10979 (JUL-Conf-16(Vol.1), pp 63) GENERATOR COORDINATE METHOD FOR HIGH SPIN STATES. Gruemmer, F.; Schmid, K. W.; Faessler, A. (Inst. fuer Kernphysik, Juelich, Ger.). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10980 (JUL-Conf-16(Vol.1), pp 78) PRE-EQUILIBRIUM MODEL DESCRIPTION OF π^- ABSORPTION IN NUCLEI. Gadioli, E.; Gadioli Erba, E.; Sona, P. G. (Milan Univ.). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10981 (JUL-Conf-16(Vol.1), pp 79) BEEFALO: A REFORMULATION OF THE HYBRID AND EXCITON MODEL. Ernst, J. (Univ., Bonn). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10982 (JUL-Conf-16(Vol.1), pp 94) MICROSCOPIC APPROACH TO THE STRUCTURE OF HIGHLY EXCITED HOLE STATES. Fritsch, W.; Lipperheide, R.; Wille, U. (Hahn-Meitner-Inst. fuer Kernforschung, Berlin). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10983 (JUL-Conf-16(Vol.1), pp 100) DEEPLY-BOUND HOLE STATES AND CORE-HOLE ISOSPIN VIBRATION. Nomura, M. (Univ. of Groningen, Netherlands). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10984 (JUL-Conf-16(Vol.1), pp vp) EXCITATION OF THE ANALOGUE-DIPOLE STATE IN ^{28}Si(n,p)^{28}Al. Bharuth-Ram, K. (Univ. of Durban-Westville, Durban, South Africa); Brooks, F. D.; McMurray, W. R.; Perez, S. M.; Wynchank, S. Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst fuer Kernphysik).

10985 (JUL-Conf-16(Vol.1), pp vp) MICROSCOPIC STATISTICAL THEORY OF PRECOMPOUND REACTIONS AND ANGULAR DISTRIBUTIONS. Agassi, D.; Mantzouranis, G.; Weidenmueller, H. A. (Max-Planck-Institut fuer Kernphysik, Heidelberg, Ger.). Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10986 (JUL-Conf-16(Vol.1), pp vp) NUCLEAR STRUCTURE EFFECTS IN PRECOMPOUND EMISSION. Magda, M. T. (Inst. for Atomic Physics, Bucharest); Alevra, A.; Lukas-Koch, I. R.; Blann, M. Jul 1975.
From conference on highly excited states of nuclei; Juelich, F. R. Germany (22 Sep 1975).
In international symposium on highly excited states in nuclei, Juelich, 23–26 September 1975. Volume 1. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik).

10987 (LYCEN-75-02, pp 1-11 (pt. C1)) THE UNIFIED THEORY OF NUCLEAR REACTIONS. Tobocman, W. [nd].
From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).
In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire).
A unified nuclear reaction theory is a formalism for the scattering reactions of many-body nuclear systems which is capable of describing both direct interaction and compound nucleus formation processes. The Feshbach projection operator formalism is the original unified nuclear reaction theory. An alternative unified-nuclear reaction theory called the X-matrix formalism is described. The X-matrix formalism is a generalization of the Brown-de Dominicis formalism. It does not require projection operators and is readily applied to rearrangement collisions. (FR)

10988 (LYCEN-75-02, pp 1-11 (pt. C2)) VARIATIONAL PRINCIPLES FOR NUCLEAR REACTIONS. Tobocman, W. [nd].
From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).
In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire).
In the quantum mechanical m-level approximation the problem is solved exactly in a restricted basis of m states. For the bound state problem this reduces to the determination of the eigenvalues and eigenvectors of a Hermitian m × m matrix. For the scattering problem the method requires the approximate inversion of an operator using an m state basis. The use of this approach in conjunction with variational principles is discussed for scattering; particular attention is paid to the complication connected with multipartition or rearrangement scattering. (FR)

10989 (LYCEN-75-02, pp 1-13(Pt.C5)) MASS PARAMETERS BY ADIABATIC APPROXIMATION. Vautherin, D. [nd]. (In French).
From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).
In 3rd biennial session of nuclear physics. La Toussuire, 10–15 February 1975. (Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire).
The adiabatic time-dependent Hartree–Fock theory is reviewed and applied to the description of monopole and quadrupole vibrations. Explicit expressions for the corresponding mass parameters are derived in the case where the collective variable is a scaling variable. (FR)

10990 (LYCEN-75-02, pp 1-30(Pt.C6)) HYPERSPHERICALS AND SHELL-MODEL. Fabre de la Ripelle, M. [nd]. (In French).
From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).
In 3rd biennial session of nuclear physics. La Toussuire, 10–15 February 1975. (Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire).
The one- and two-body coefficients needed for the calculation of various density and of the first of the coupled equations of the hyperspherical expansion method for the ground state of nuclei were given. Expressions for the effective potential and the one- and two-body densities were determined. (FR)

10991 (LYCEN-75-02, pp 1-8 (Pt.C7)) APPLICATIONS OF COUPLED EQUATIONS. Raynal, J. [nd]. (In French)
From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).
In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire).
Some improvements of the coupled channel program, the principles of which were described during earlier sessions, and the most interesting results obtained with this program are presented. The analyzing power of a 2^+ state in p p' scattering depends strongly on the quadrupole moment of the excited state. The folding of an α-nucleon potential added by some physicists at Karlsruhe gives good fits of their α-scattering at 104 MeV with parameters deduced from proton scattering. This program is more and more used for heavy ions. (FR)

10992 (LYCEN-75-02, pp 1-37 (Pt.C8)) RECOIL AND FINITE RANGE EFFECTS IN HEAVY-ION TRANSFER REACTIONS. Elbaz, E. [nd].

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire).

A review of the different approaches of the recoil and finite range effects in heavy-ion transfer reactions is given. One-nucleon and two-nucleon transfer reactions were considered. It is shown how phase approaches are related to each other and what results they have yielded. (FR)

10993 (LYCEN-75-02, pp 1-7 (Pt.C9)) PIONIC FIELD IN NUCLEI. Ericson, M. [nd]. (In French)

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire).

A description of the modification of the pionic field of a nucleon inside a nucleus is based on an optical potential description. In large nuclei the modification at zero momentum transfer is shown to arise from the short range correlation. The implications for the renormalization of the axial coupling constant are discussed. (FR)

10994 (LYCEN-75-02, pp 1-33 (Pt.C11)) SEMICLASSICAL APPROXIMATION AND COMPLEX TRAJECTORIES. Knoll, J.; Schaeffer, R. [nd]. (In French)

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire).

Complex solutions of the classical Hamilton-Jacobi equations are considered. Whereas the real solutions describe the refractive phenomena, the complex ones give rise to the diffraction. The theory is used in order to describe elastic and inelastic scattering of heavy ions. (FR)

10995 (LYCEN-75-02, pp 1-11 (Pt.C12)) DERIVATION OF THE CRANKING HAMILTONIAN FROM THE VARIATIONAL PRINCIPLE. Ripka, G. [nd]. (In French)

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire).

The variational principle is used to derive the single-particle potential of a nucleon in an even-even deformed nucleus which has a given angular momentum. Three cases are distinguished according to the value of the angular momentum: the case of low angular momentum, the case of triaxial symmetry about the rotation axis. In each case it is shown that the Hamiltonian has the form of a cracking Hamiltonian $h-\omega J_x$. (FR)

10996 (LYCEN-75-02, pp 1-24 (Pt.C13)) SOME ASPECTS OF THE HEAVY ION PHYSICS. Harar, S. [nd]. (In French)

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire).

Heavy ion induced reactions have two particularly interesting properties in nuclear spectroscopy. On one hand, they carry a lot of angular momenta in nuclei and so favor the population of high spin states, and on the other hand they allow one to transfer clusters and then to study multinucleon excitations. Some examples are analyzed using the framework of compound nucleus and direct interaction theories. Results clearly show that they are powerful probes of nuclear structure. (FR)

10997 (LYCEN-75-02, pp 1-26 (Pt.C15)) HEAVY ION SCATTERING AND MOLECULAR MODEL. Becker, F. [nd]. (In French)

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire).

In order to describe elastic and inelastic scattering of two heavy ions formed with identical hard cores, one of them having one valence nucleon (or cluster), one discusses a model based on a multiple exchange of the valence nucleon (or cluster) between the two cores, as it occurs in the collision of atoms and ions. The equation of the model is discussed and the results obtained previously in simple situations are compared with the experimental data which show specific features due to the interference between the direct and exchange amplitudes. The model is compared with the DWBA to which it becomes equivalent when the transfer occurs in one step. (FR)

10998 (LYCEN-75-02, pp 1-10 (Pt.C16)) NATURE AND IMPLICATIONS OF CORE POLARIZATION PHENOMENA IN NUCLEAR PHYSICS. Zuker, A. P.; Cortes, A.; Pasquini, E. [nd].

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire).

It is shown that global properties of nuclear systems - and in particular Hartree-Fock self-consistency can be rigorously treated in restricted model space, through operator renormalization. Examples are given to show the need of many body forces and operators in particular cases. A possible theoretical framework is proposed which seems to offer some conceptual advantages in describing coupling to degrees of freedom external to the model space. Special attention is paid to monopole isoscalar and isovector polarizability, associated to spherical self-consistency. (FR)

10999 (LYCEN-75-02, pp 1-2 (Pt.S2)) DENSITY DEPENDENCE OF THE ENERGY OF THREE-BODY CORRELATIONS IN NUCLEAR MATTER. Grange, P. [nd]. (In French)

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire).

The three-body correlation energy was calculated in nuclear matter after the Bethe-Dahlblom formalism with the Reid potential. (FR)

11000 (LYCEN-75-02, pp 1-6 (Pt.S6)) TWO-CENTER BASIS ADAPTED TO HARTREE-FOCK CALCULATION. Berger, J. F.; Gogny, D. [nd]. (In French)

From 3rd biennial session of nuclear physics; La Toussuire, France (10 Feb 1975).

In 3rd biennial session of nuclear physics. La Toussuire, 10-15 February 1975. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire).

A two-center basis was built in order to apply the Hartree-Fock method to nuclear fission and heavy-ion collision problems. (FR)

11001 (PUC-TN-15/74) FINITE CHANNEL WIDTH AND THE ANALYSIS OF EXPERIMENTAL DATA. Ponczek, R. L.; de Castro Faria, N. V.; Guimaraes, A. P. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil). Instituto de Fisica). Oct 1974. 8p. INIS.

The distortion introduced in the data accumulated in a multichannel analyser due to the finite width of the channels is easily taken into account in the analysis, when the function describing the phenomenon is known and can be integrated analytically over the channel width. This idea was applied to the analysis of simulated Lorentzian lines, i.e., lines with a priori known parameters. The parameters derived from least squares fits using (a) a Lorentzian function and (b) the integrated function were compared with the original values for different ratios of channel width to peak width. (INIS)

11002 NONLOCAL SEPARABLE MATRIX N-N POTENTIAL. Hammann, T. F.; Desgrolard, P.; Chetouani, L. (Institut d'Etudes Nucleaires, Algiers). Nuovo Cim.; 29A: No. 2, 199-224(21 Sep 1975).

One provides an exponentially decaying separable N-N channel potential which is characterized by being of a matrix type, and by leading to a transition matrix of the same general form as the potential. The wave functions are calculated for the scattering states and for the bound state. One determines numerically the parameters for a 2×2 matrix potential from the experimental phase shifts, low energy parameters and properties of the deuteron. This potential is then used to calculate the binding energy of a nucleon in the nuclear matter up to second order in perturbation theory, the symmetry energy per particle, the increase of the cross section of the electric-dipole transition due to the exchange character of the nuclear force, and the binding energy of the nuclei ^{16}O and ^{40}Ca in first- and second-order perturbation theory. On the whole, the matrix character of the proposed force presents some advantages with respect to other nucleon-nucleon forces, the main failures being too large NM symmetry and second-order potential energies. (auth)

11003 NUCLEAR POTENTIALS DETERMINED FROM THE NONLINEAR MESON THEORY. Wang, C. S. (National Taiwan Univ., Taipei); Hwang, J. L.; Chang, Z. S. Chin. J. Phys. (Taiwan); 13: No. 1, 69-71(Apr 1975).

The proton densities for nuclei with nucleon number, A, ranging from 40 to 209 are used to determine the nuclear potentials by solving the nonlinear wave equation of a classical neutral scalar meson field. These proton densities were measured from the high-energy electron scattering experiment by Hahn, Ravenhall and Hofstadter. The nuclear potentials determined are fitted to two types of approximate formula. When A is given, the potentials may be readily calculated from these formulas. Next, a comparison is made between the conventionally used Woods–Saxon potential and the potential given by these formulas. (1 figure) (auth)

11004 NONUNITARY MODEL OPERATOR APPROACH TO TWO-PARTICLE CORRELATIONS IN FINITE NUCLEI. Massen, S. E.; Grypeos, M. E. (Univ. of Thessaloniki, Greece). Nuovo Cim., A; 30A: No. 1, 34-46(1 Nov 1975).

A model operator-variational approach is considered for the determination of the two-particle correlations in finite nuclei. The essential difference from some other work is that the model operator is not assumed to be (left) unitary. Two different expressions for the two-body part in a cluster expansion of the energy functional $(\Delta E)_2$ are first obtained and a variational method with a separation condition is subsequently applied. This leads in general to coupled equations for the correlated, relative, two-nucleon waves functions. Finally, the method is applied to the calculation of the binding energy of the ^{4}He nucleus. (auth)

11005 STRONG-COUPLING EXPANSION FOR ENERGY EIGENVALUES. Galindo, A. (Univ. of Madrid); Pascual, P. Nuovo Cim., A; 30A: No. 1, 111-125(1 Nov 1975).

A simple method is presented to expand the eigenvalues $E_{nl}(g)$ for a central potential V(r), with Coulomb behavior at the origin, as a power series in 1/g. The rational approximants to such series may provide accurate estimates of $E_{nl}(g)$. The merits of this strong-coupling expansion method are illustrated for the Yukawa potential. As shown, the technique developed works extraordinarily well in this typical example. (auth)

11006 EXCITATION FUNCTIONS FOR NUCLEAR REACTIONS WITH CHARGED PROJECTILES. Muenzel, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie). KFK Nachr.; 7: No. 2, 36-37(Jul 1975). (In German)

2 figs.; 1 tab.

The article compares the exactness of calculated excitation functions for nuclear reactions with the experimental values. The dependence of the computer time on the model used is given as well as the exactness of the excitation function for thick targets. (GE)

11007 FINE STRUCTURE OF ISOBARIC ANALOG RESONANCES AND POLARIZATION. Harney, H. L. pp 212-228 of Polarization Nuclear Physics. Proceedings. Fick, D. (ed.). (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Berlin; Springer (1974).

From meeting on polarization physics; Ebermannstadt, F. R. Germany (1 Oct 1973). 24 refs.

The effect of the fine structure of isobaric analog resonances on polarization and analyzing intensity in elastic and inelastic scattering is investigated. Starting from the Hauser–Feshbach theory, the channel-channel correlation with inelastic scattering is described. (GE)

11008 DIRECT INTERACTION. Haeberli, W. (Wisconsin Univ., Madison (USA). Dept. of Physics). pp 229-267 of Polarization Nuclear Physics. Proceedings. Fick, D. (ed.) (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Berlin; Springer (1974).

From meeting on polarization physics; Ebermannstadt, F. R. Germany (1 Oct 1973). 29 figs.; 63 refs.

The elastic scattering and its interpretation within the framework of the optical model and nucleon transfer reactions such as (d,p)-stripping reactions and (p,d) pick-up reactions are dealt with in this article. Polarization influences are included here in most cases. (GE)

11009 POLARIZATION PHENOMENA IN INELASTIC SCATTERING. Verhaar, B. J. (Technische Hogeschool Eindhoven (Netherlands). Dept. of Physics). pp 268-292 of Polarization Nuclear Physics. Proceedings. Fick, D. (ed.) (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Berlin; Springer (1974).

From meeting on polarization physics; Ebermannstadt, F. R. Germany (1 Oct 1973). 7 figs.; 34 refs.

The inelastic proton scattering according to the optical model is dealt with in a macroscopic description with nuclear deformation and a microscopic description. (GE)

11010 ISOBARIC ANALOG RESONANCES. Graw, G. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Tandemlabor). pp 184-211 of Polarization Nuclear Physics. Proceedings. Fick, D. (ed.) (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Berlin; Springer (1974).

From meeting on polarization physics; Ebermannstadt, F. R. Germany (1 Oct 1973). 17 figs.; 5 tabs.; 37 refs.

Since the first polarization experiment near an isobaric analog resonance (IAR) in 1966, a large number of nuclei have been investigated in elastic and inelastic proton scattering. These polarization experiments have been performed to obtain quantitative spectroscopic information concerning the parent nuclear state or to study the reaction mechanism. In those cases where both "direct" and "Hauser–Feshbach" scattering contribute, polarization experiments exhibit very clearly special properties of the IAR as a doorway state phenomenon. Here, only few experiments are discussed, selected to illustrate the technique of the analysis and to show the power of polarization experiments for the investigation of the various aspects of the IARs. (GE)

11011 RESONANCES, POLES, AND POLARIZATION. Plattner, G. R. (Basel Univ. (Switzerland)). pp 162-183 of Polarization Nuclear Physics. Proceedings. Fick, D. (ed.) (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Berlin; Springer (1974).

From meeting on polarization physics; Ebermannstadt, F. R. Germany (1 Oct 1973). 20 figs.; 1 tab.; 10 refs.

In these short notes we want to give a "naive," conceptual introduction into some aspects of resonance phenomena in nuclear reactions. The poles of the S-matrix provide an excellent means of parametrizing such resonances. We shall therefore try to show how an experimentalist can deduce pole positions and residues from his measurements, and how these parameters are related to nuclear structure. Unless explicitly stated otherwise, our remarks apply to the elastic scattering of spinless particles in the absence of inelastic processes. (GE)

11012 NUCLEON–NUCLEON FORCE. McKee, J. S. C. (Birmingham Univ. (UK). Dept. of Physics). pp 88-113 of Polarization Nuclear Physics. Proceedings. Fick, D. (ed.) (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Berlin; Springer (1974).

From meeting on polarization physics; Ebermannstadt, F. R. Germany (1 Oct 1973). 8 figs.; 55 refs.

The various models to describe the NN potential and the NN interaction are dealt with: tensor forces, L-S coupling, OPE model, local and non-local potentials as well as three-body problems. (GE)

11013 THEORY OF POLARIZATION MEASUREMENTS. Observables, Amplitudes, and Symmetries. Simonius, M. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Kernphysik). pp 38-87 of Polarization Nuclear Physics. Proceedings. Fick, D. (ed.) (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Berlin; Springer (1974).

From meeting on polarization physics; Ebermannstadt, F. R. Germany (1 Oct 1973). 26 refs.

The first and major part of these lectures is concerned with the general formalism of polarization measurements. In chapter 1, the description of polarized beams and their measurement is discussed. Chapter 2 contains the formalism for scattering and reactions. Only 2 particle final states are treated explicitly, but the generalization to more particle final states in particular for the definition of observables is straight forward. In sec. 10 decay angular distributions are treated with emphasis on their use as a very convenient tool to measure the polarization of excited or particle unstable states—a method for obscure reasons usually omitted in treatments of polarization phenomena in nuclear physics. (auth)

11014 SIMPLE EFFECTIVE NUCLEAR POTENTIAL DERIVED FROM REALISTIC MATRIX ELEMENTS. Arichx, F.; van Leuven, P. (Rijksuniversitair Centrum te Antwerpen (Belgium). Faculty of Science); Bouten, M. (Limburgs Universitair Centrum (Belgium). Dept. of Physics). Z. Phys., A; 273: No. 2, 205-209(Jun 1975).

5 tabs.; 7 refs.

A central nucleon-nucleon force, consisting of two Gaussian potentials with general exchange mixtures, is adapted to the realistic matrix elements of Golanska, Faessler and Appel. The resulting effective interaction is discussed and tested in a projected Hartree-Fock calculation for ^{8}Be. (auth)

11015 FROM THE ATOMIC NUCLEUS TO UNIVERSE. A Report About the Tasks and the Aims of Research of the Max-

Planck-Institut of Nuclear Physics in Heidelberg. Kiko, J.; Schmidt-Rohr, U. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Umsch. Wiss. Tech.; 75: No. 12, 359-369(Jun 1975). (In German)

12 figs.; 6 refs.

Nuclear physics and cosmochemistry are the principal fields of research of the Max-Planck-Institut of Nuclear Physics in Heidelberg. Regarding research in nuclear physics, the emphasis is put on the investigations into the structure of the atomic nucleus whilst cosmochemistry is concerned with aims of research comprehensible to the public in general, e.g. the coming into being and the age of meteorites, the moon, and planets. The findings of cosmochemistry contribute to a better understanding of the development of our solar system. The article deals in brief with the Institute at Heidelberg. (GE)

11016 COLLECTIVE NUCLEAR STATES AS REPRESENTATIONS OF A SU(6) GROUP. Arima, A. (Department of Physics, University of Tokyo, Tokyo, Japan); Iachello, F. Phys. Rev. Lett. 35: No. 16, 1069-1072 (20 Oct 1975).

We propose a description of collective quadrupole states in even-even nuclei in terms of representations of a boson SU(6) group. We show that within this model both the vibrational and the rotational limit can be recovered. (auth)

11017 BACKBENDING FEATURE OF ROTATIONAL SPECTRA IN THE GENERALIZED VARIABLE-MOMENT-OF-INERTIA MODEL AND ITS EQUIVALENCE WITH THE HARRIS MODEL. Mantri, A.N. (Nuclear Physics Section, Department of Physics, Banaras Hindu University, Varanasi 221005, India). Phys. Rev. C 12: No. 5, 1687-1689 (Nov 1975).

The equivalence of Harris model equations with those of the generalized variable-moment-of-inertia (GVMI) model given by Das *et al.* is examined in the light of the backbending feature of the rotational states. It is shown that this feature is absent in the Harris model taken to any order. The GVMI model equations are found to be consistent and in one-to-one correspondence with an expansion of the square of the angular velocity in terms of a polynomial in the moment of inertia rather than with the Harris expansion and may give a backbending feature in some cases depending on the relative values of the parameters appearing in the potential energy term. (auth)

11018 COULOMB DISPLACEMENT ENERGIES OF EXCITED STATES. Sherr, R. (Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08540); Bertsch, G. Phys. Rev. C 12: No. 5, 1671-1677 (Nov 1975).

The Bansal-French-Zamick model is quite successful in accounting for the Coulomb displacement energies of excited particle-hole states in a variety of light nuclei. Level shifts are typically reproduced to within 50 keV. However, the model fails for certain excited 0^+ states, and this remains a puzzle. (auth)

11019 SELF-CONSISTENT ORTHONORMALIZATION AND THE BCS TREATMENT OF THE CHARGE-INDEPENDENT PAIRING CORRELATION. Ghosh, M.K. (University of Mosul, Mosul, Iraq); Goswami, A.; Majumdar, S.R. Phys. Rev. C 12: No. 5, 1650-1658 (Nov 1975).

A derivation of the pairing theory for nuclei is given based on a self-consistent orthonormalization procedure within the context of the equation of motion method. The procedure to minimize the fluctuation effects due to nonconservation of the nucleon number is given. The method is extended for treating the charge independent ($T=1$) pairing correlations. A new method to deal with the fluctuations due to nucleon number and isospin simultaneously, is outlined. Numerical computations are performed for the case of $N=Z$ nuclei. (auth)

11020 DISTORTED-WAVE APPROXIMATION AND NUCLEAR CORRELATIONS IN PION REACTIONS. Nagl, A.; Cannata, F. (Department of Physics, Catholic University of America, Washington, D.C. 20064); Überall, H. Phys. Rev. C 12: No. 5, 1586-1588 (Nov 1975).

The final- (or initial-) state interactions of pions participating in reactions with a complex nucleus are usually treated in distorted-wave impulse approximation with optical model wave functions. We improve this approximation by using an "effective pion field" which takes into account the hard-core nuclear correlations. This is illustrated here by the example of charged pion photoproduction from a ^{12}C target. (auth)

11021 PION ELASTIC SCATTERING FROM ALIGNED TARGETS. Iverson, M.S.; Rost, E. (Nuclear Physics Laboratory, Department of Physics and Astrophysics, University of Colorado, Boulder, Colorado 80302). Phys. Rev. C 12: No. 5, 1589-1594 (Nov 1975).

The differences in the interactions of π^+ and π^- particles with neutrons and protons can be used to investigate relative neutron and proton densities in nuclei. The use of aligned targets with π^+ and π^- beams presents considerable advantages for the extraction of neutron density information. As a framework for estimating pion scattering from aligned targets we use the Kisslinger optical potential including a deformed nucleon density distribution. The difference between aligned and unaligned differential cross sections (deformation effect) is found to be linear in β and allows for the extraction of neutron density shape information. (auth)

11022 FIELD-THEORETIC LOW EQUATION APPROACH TO PION-NUCLEUS SCATTERING. Cammarata, J.B. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742); Banerjee, M.K. Phys. Rev. C 12: No. 5, 1595-1606 (Nov 1975).

From the pion-nucleus Low equation in the one-meson approximation we obtain an uncoupled, nonlinear, singular integral equation to determine the crossing symmetric elastic pion-nucleus scattering amplitude. The driving term of this equation is evaluated in an impluse single-scattering approximation for ($J^\pi = 0^+$, $I = 0$) ground state nuclei. It is found that unitarity requires that we include the effects of the strong absorption of the low partial waves in the entrance and exit channels. Thus, we introduce distortion of the pion waves by a procedure used in the inelastic peripheral scattering of elementary particles. Numerical results are presented for the iterative solution of this equation for π-^{12}C scattering in the energy region of the (3,3) resonance. (auth)

11023 EFFECTIVE CHANNEL APPROACH TO NUCLEAR SCATTERING AT HIGH ENERGIES. I. Hahn, Y.; Rule, D.W. (Department of Physics, University of Connecticut, Storrs, Connecticut 06268). Phys. Rev. C 12: No. 5, 1607-1615 (Nov 1975).

The elastic scattering of high-energy particles by composite target nuclei is formulated in terms of coupled equations in which the effect of inelastic processes is represented by an average inelastic channel. The average fluctuation energy and fluctuation potentials which specify this channel are explicitly constructed and shown to be related to the two- and three-particle correlation functions. The theory incorporates approximately the effects of nonlocality, energy-dependence, rescattering, and absorption of all the inelastic channels. Systematic improvements of the method as well as several extensions of the formalism to target excitations and particle exchanges are discussed. (auth)

11024 QUALITATIVE BEHAVIOR OF HEAVY-ION ELASTIC SCATTERING ANGULAR DISTRIBUTIONS. Fuller, R.C. (Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. C 12: No. 5, 1561-1574 (Nov 1975).

To study the qualitative features of elastic scattering in the presence of strong absorption, the scattering amplitude is decomposed into what the semiclassical approach calls positive- and negative-deflection-angle contributions. For an amplitude obtained from partial-wave summation this is done without approximation by considering the two amplitudes corresponding to the decomposition of each Legendre polynomial into its two traveling-wave components. It is necessary to separately consider the amplitude arising from the infinite-range Coulomb interaction which does not admit a partial-wave expansion. To decompose this amplitude we follow an approach which leads to increased understanding of the "diverging lens" effect of the Coulomb field and the related Fraunhofer and Fresnel diffraction structure of angular distributions. In addition, the absence or presence of oscillation at back angles is shown to be related to the dominance of reflective or "encirclement" scattering. By examining the phase of the positive-deflection-angle contribution to the scattering amplitude, we are able to conclude, in agreement with Frahn, that the smooth fall in tandem heavy-ion elastic angular distributions arises from a diffractive shadow and not a refractive or Coulomb-rainbow shadow. (auth)

11025 *R*-MATRIX DESCRIPTION OF SCATTERING FROM OPTICAL MODEL POTENTIALS. Philpott, R.J. (Department of Physics, Florida State University, Tallahassee, Florida 32306). Phys. Rev. C 12: No. 5, 1540-1546 (Nov 1975).

The reduction of the dynamical equations of the Lane-Robson reaction formalism, reported previously, is extended to the important case in which the nuclear Hamiltonian contains absorptive and linearly energy dependent terms. The method is illustrated by an *R*-matrix analysis of two potential models fitted to $^{16}O + ^{16}O$ elastic scattering data in the energy region 10 MeV $< E_{c.m.} <$ 35 MeV. The *R*-matrix method provides an economical representation of the model solutions and yields further insight into the nature of the resonance structure predicted by these models. (auth)

11026 NUCLEAR FISSION. Irvine, J. M. (Univ. of Manchester, Eng.). Sci. Prog. (Oxford); 62: No. 248, 501-522(1975).

It is energetically favorable for extremely heavy atomic nuclei to split into two or more lighter fragments and yet extremely few nuclei do spontaneously fission. On the other hand, there are a number of ways in which nuclei can be induced to fission. The systematics of spontaneous and induced fission are examined and an outline theory of nuclear fission is presented. In conclusion there is a very brief discussion of the relevance of fission characteristics to the fueling of nuclear reactors. (auth)

11027 (e,e'gamma) AND (e,e'gamma gamma) SCATTERING IN THE OSCILLATING LIQUID DROP MODEL. McCown, R. B. Stanford, CA; Stanford Univ. (1975). 156p. University Microfilms Order No. 75-21,885.

Thesis (Ph. D.).

When a nucleus is examined by high energy electron scattering, it is difficult to separate two states of the nucleus which have nearly identical energies by analyzing the kinematics of the reaction. Two higher-order reactions are examined. A second-order reaction examined is electron excitation from the ground state to an excited state followed by gamma decay directly back to ground. In addition the third-order reaction involving electro-excitation from the ground state to an excited state followed by gamma decay to an intermediate energy state followed by gamma decay to ground is discussed. The formalism for both reactions is derived using the first Born approximation. The coincidence cross section of the second-order reaction is found with the direction of the decay gamma correlated to the direction of the scattered electron. The cross sections are given in terms of reduced matrix elements of the electromagnetic operators. An harmonic oscillator liquid drop model is employed to represent the nuclear physics in the problem. The transition probabilities are discussed. Eight possible energy spectra with energy levels ranging from five MeV to ten MeV are chosen for a liquid drop with atomic weight of 40 and with 20 units of charge. The calculations agree with previous electron-gamma correlation studies. The previous work is extended here to include multiple gamma correlations. (Diss. Abstr. Int., B)

11028 ANTISYMMETRIZATION AND CORE EXCITATION IN DEUTERON-NUCLEUS SCATTERING. Pong, W. S. Pittsburgh; Univ. of Pittsburgh (1974). 98p. University Microfilms Order No. 75-18,251.

Thesis (Ph. D.).

The effects of antisymmetrization in deuteron-nucleus scattering are studied under the assumption that the target is unexcited during scattering. The effective Hamiltonian that governs the motion of the nucleons in the deuteron is derived. An energy dependent, local potential that is equivalent to the nonlocal correction is obtained using the local W. K. B. approximation. The effective interaction caused by virtual target excitations is studied. The deuteron excites the target via two different processes--one nucleon in the deuteron excites and deexcites the target, or one nucleon excites the target while the other nucleon deexcites it. The latter process is studied in comparison with the effects from the former process. In elastic scattering, the former process affects only forward scattering, and its effects are almost independent of the angular momentum of the target excited state lambda, whereas the latter process affects backward scattering, and its effects decrease rapidly with increasing lambda and alternate in sign as (-1)/sup lambda/. The effects on elastic scattering from the latter process are probably much smaller than those from the former process. However, further study is necessary before a more definite conclusion can be reached. (Diss. Abstr. Int., B)

11029 UPPER LIMITS ON POLARIZATION EFFECTS IN NUCLEAR COLLISIONS. Mohr, C. B. O. (Univ. of Melbourne). Aust. J. Phys.; 28: 133-140(1975).

The increase in cross section for inelastic collisions due to polarization of the target by the projectile has an upper limit in a simple model. The usual treatment of core polarization in nuclear collisions gives a polarization potential which is too large because of the use of perturbation theory and the neglect of dynamic effects, and which is in phase with the direct coupling potential contrary to recent experimental evidence and to channel coupling theory. (auth)

11030 PIONS SCATTER BY NUCLEI. Huefner, J. (Univ., Heidelberg). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 1-16 (1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Are pions a good tool to study nuclei. If the emphasis of this question rests on "tool," the answer must be "not yet." The reason: one does not even understand how a pion interacts with a nucleus. This is part of the many-body problem for strongly interacting particles and its study is a basic problem in physics. One must investigate questions like: Can one understand pion-nucleus interactions from pion-nucleon physics. How does a DELTA-resonance look in nuclei. Once one has solved those basic problems, there will be spinoffs in medical, technical and nuclear areas. Then pions can be used as a tool to study nuclear properties. (auth)

11031 PION-NUCLEUS REACTION PROCESSES. Eisenberg, J. M. (Univ. of Virginia, Charlottesville). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 17-39(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The developments of the two years in the area of pion-nucleus reactions at low and medium energies are reviewed. Primary attention is given to the processes (pi,pi'N), (pi, 2N), (pi,gamma) and (gamma,pi), (p, pi) and (pi, p), and pi + A yields A' + [pi' .] + nuclear aggregates. (auth)

11032 INELASTIC ELECTRON SCATTERING. Bertozzi, W. (Massachusetts Inst. of Tech., Cambridge). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 409-436(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Some examples of developments in the field of inelastic electron scattering are given including the physics of this study, an application of electromagnetic transition densities to beta decay, negative muon capture, and positive pion photoproduction in lithium-6 and helium-6, giant resonances, vibrational states in zinc-64, -66, and -68, shapes of deformed nuclei, recent results from Saclay on chromium-52, and recent results from MIT. (JFP)

11033 PIONIC DEGREES OF FREEDOM IN NUCLEI. Rho, M. (CEN de Saclay, Gif-sur-Yvette, France). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 666-676(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

The treatment of pionic degrees of freedom in nuclei includes evidence in the two-nucleon system, modified weak form factors for nuclear matter, second-class current: can the nucleus reveal its origin; and probe of the pion cloud, possible pion condensation. The ultimate goal is to be able to find a consistent theory (possibly a field theory of the nucleus) which can account for all these phenomena and others without making independent assumptions. (JFP)

11034 pi-CONDENSATION AND ABNORMAL NUCLEI. Migdal, A. B. (Landau Inst. of Theoretical Physics, Moscow). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 677-685(1975).

From 6th international conference on high energy physics and nuclear structure; Sante Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

An attempt is made to improve and to consider in more detail the results obtained previously on pion condensation in abnormal nuclei. The question of the existence of superdense nuclei and nuclei with anomalously low density, the possible existence of neutron nuclei, and the possibility of the existence of supercharge (Z is contained in (137)/sup $\frac{3}{2}$/) nuclei due to pion condensation in an electric field is discussed. (JFP)

11035 ABNORMAL STATES OF NUCLEAR MATTER. Castillejo, L. (State Univ. of New York, Stony Brook). AIP (Am. Inst. Phys.) Conf. Proc.; No. 26, 686-699(1975).

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975). See CONF-750631-.

Results for abnormal states in nuclear matter are reviewed and compared with pi$^-$ condensates in the context of chiral invariance and the sigma model. The relative importance of symmetry breaking and conserving interactions is assessed for the two problems. Vacuum self energy effects are crucial in abnormal matter calculations particularly when finite size abnormal nuclei are considered. (auth)

11036 PROBLEMS OF VIBRATIONAL NUCLEI. Proceedings of the Topical Conference on Problems of Vibrational Nuclei, Zagreb, Yugoslavia, September 24-27, 1974. Alaga, G.; Paar, V.; Sips, L. (eds.). Amsterdam; North-Holland Publishing Company (1975). 466p. (CONF-740992-). $41.75.

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974).

Separate abstracts for twenty-three papers appear in Nuclear Science Abstracts, four of which appear also in ERDA Research Abstracts. (JPF)

For abstracts of individual papers see: 10750, 10782, 10838–10843, 10882, 10905–10908, and 11037–11046.

11037 EQUIVALENCE BETWEEN FEYNMAN–GOLDSTONE AND PARTICLE-PHONON DIAGRAMS FOR FINITE MANY-BODY SYSTEMS. Bes, D. R. (Comision Nacional de Energia Atomica, Buenos Aires); Broglia, R. A. pp 1-14 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

The equivalence between the description of the many-body finite

nuclear system in terms of traditional Feynman diagrams involving only the Fermion degrees of freedom and of Feynman diagrams involving Fermions and phonons degrees of freedom is proved for a general two-body residual interaction. 7 figures. (auth)

11038 CLUSTER-VIBRATION MODEL AND GVISR. Paar, V. (Inst. Rudjer Boskovic, Zagreb). pp 15-53 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

Nuclei with few particles or holes in the proton or neutron valence shell or subshell are described in the cluster-vibration model (CVM). Discussion is restricted to quadrupole vibrations since these are of primary importance for most nuclear low-lying spectra. Specific examples are cited for odd isotopes of Mn, Ga, Ag, I, Au, and At. In addition, odd N = 25, 31, 47, 53, 79, and 85 nuclei are briefly discussed. Starting with a zeroth order classification of states as clusters and multiplets based on clusters yields the generalized vibrational intensity and selection rules (GVISR) classification. E2 transitions and moments are considered in this scheme and illustrations are given for the Alaga model. It is concluded that CVM represents a useful quantum mechanical representation for description of nuclear properties of spherical nuclei and near-transitional nuclei, but that some useful properties may be extracted by starting directly from the zeroth order situation. 6 tables, 15 figures, 47 references. (SDF)

11039 PARTICLE-VIBRATION COUPLING AND RELATED PHENOMENA. Hamamoto, I. (NORDITA, Copenhagen). pp 54-74 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

A general discussion is given of the particle-vibration coupling approach to the nuclear many-body problem. As an example, the lowest lying octupole vibrational state of ^{208}Pb is illustrated. Special attention is given to the p-v coupling and its consistency in the case of shape oscillations in the presence of neutron excess. Finally, the consistency in the description of the one-octupole phonon states is estimated. 15 figures, 4 tables. (SDF)

11040 STRUCTURE DESCRIPTION OF SPHERICAL NUCLEI. Janssen, D. (Joint Inst. for Nuclear Research, Dubna, USSR). pp 75-86 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

Two new methods in the theory of phonon-phonon and phonon-quasi particle interactions are presented which allow reproduction of many experimental characteristics of spherical nuclei. Results of calculations of properties of excited states are tabulated for N = 80, 82 and 84 isotones and for Te, Su, and Cd isotopes. It is indicated that for a description of spherical nuclei, the anharmonicity of the collective quadrupole motion and the interaction of phonons with quasi particles must be taken into account. 4 tables, 4 figures. (SDF)

11041 NEW MICROSCOPIC THEORY OF COLLECTIVE EXCITATIONS IN SPHERICAL ODD-MASS NUCLEI. Kuriyama, A. (Kyushu Univ., Fukuoka); Marumori, T.; Matsuyanagi, K. pp 87-107 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

A systematic microscopic theory is described which extends the conventional quasi particle random phase approximation for spherical even mass nuclei to the case of collective excitations in spherical odd mass nuclei. Essential parts of the theory are presented and supplemented with examples and a discussion of its relation to the other typical approaches to similar problems. (SDF)

11042 BOSON EXPANSIONS AND THE CRANKING MODEL. Marshalek, E. R. (Univ. of Notre Dame, Indiana). pp 108-127 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

A systematic boson power series expansion in a small parameter is described, the first two orders corresponding respectively to the Hartree–Fock–Bogolyubov and random phase approximation terms, while higher orders are anharmonic corrections. The general properties of such perturbed boson expansions (PBE) are given. The main emphasis is on PBE as a purely theoretical tool for estimation of the accuracy of the self-consistent cranking model in higher orders. Brief treatment is given to the use of PBE to directly calculate the effect of band mixing in deformed nuclei, and effects of anharmonicity on electromagnetic moments, transistions, stripping amplitudes, etc., in spherical nuclei. 2 figures. (SDF)

11043 CORE PARTICLE COUPLING: A GENERAL APPROACH. Dreizler, R. M. (Univ., Frankfurt am Main). pp 217-229 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

General remarks are made about a self-consistent approach to core-particle coupling which yields partial information about neighboring systems in the form of energies and statements on parentage. Some qualitative features are demonstrated using two $j = \frac{1}{2}$ shells and a simple pairing interaction. Results of self-consistent calculations using a pairing plus quadrupole Hamiltonian are displayed for Sn isotopes and include gap parameters, quadrupole moment of the excited state, energies of states in odd Sn isotopes, and stripping and pickup spectroscopic factors. 4 figures, 1 table. (SDF)

11044 COLLECTIVE MODEL FOR TRANSITIONAL NUCLEI. von Bernus, L.; Greiner, W.; Rezwani, V.; Schweid, W.; Schneider, U.; Sedlmayr, M.; Sedlmayr, R. (Univ., Frankfurt am Main). pp 230-262 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

The collective model developed by Gneuss and Greiner is discussed. The model describes the quadrupole degrees of freedom of the nuclear shape by an Hamiltonian depending on the quadrupole surface coordinates. Since no restrictions on the magnitude of the quadrupole deformation are imposed like in the vibrator model and the rotator-vibrator models, the model is also capable of describing transitional nuclei as limiting cases of nearly spherical and strongly deformed nuclei. The main constituent of the Hamiltonian of the model is the potential energy surface (PES) which gives the potential as a function of the quadrupole deformation. The PES of a large variety of even-even nuclei is already deduced from the experimental low energy spectra. The obtained PES reveal transitions from oblate to prolate and triaxial nuclear shapes in several rows of isotopes. This is the beginning of a "Periodic system of collective potentials", which summarizes the main collective features of nuclei in a very transparent way. 27 figures. (auth)

11045 COLLECTIVE EXCITATIONS IN LIGHT NUCLEI. Filippov, G. F.; Ovcharenko, V. I.; Maksimenko, V. M.; Steshenko, A. I. (Inst. for Theoretical Physics, Kiev). pp 263-271 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

The generalized hyperspheric function formalism for describing collective excitations in light nuclei is described. The method depends on investigating hypersurfaces for a given interaction potential between nucleons and then finding the spectrum of collective excitations in a harmonic approximation. (SDF)

11046 COUPLING OF PARTICLES TO COLLECTIVE MODES. Choudhury, D. C. (Polytechnic Inst. of New York, Brooklyn); Malik, F. B. pp 272-301 of Problems of Vibrational Nuclei. Alaga, G. (ed.). Amsterdam; North-Holland Publishing Co. (1975).

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974). See CONF-740992-.

Various results of the coupling of one or a few particles to rotational motion are discussed. Low-lying spectra of even-even, odd-even, and odd-odd are examined in the strong coupling model, with the restrictions of axial symmetry and quadrupole deformation only. General considerations of the effect of Coriolis coupling on the motion of the system and on the moments and transition rates are given. Finally, the Coriolis coupling model is applied to calculation of low-lying states in odd, even-even, and odd-odd nuclei. 14 figures, 3 tables, 50 references. (SDF)

11047 VARIATIONAL APPROACH TO THE RELATIVISTIC TWO-CENTER PROBLEM: CRITICAL INTERNUCLEAR DISTANCE. Marinov, M. S.; Popov, V. S.; Stolin, V. L. (Inst. for Theoretical and Experimental Physics, Moscow). J. Comput. Phys.; 19: No. 3, 241-256 (Nov 1975).

As shown recently, if the distance between two heavy nuclei becomes less than its critical value, R/sub cr/, their electric potential is strong enough to create electron-positron pairs from the vacuum. This process may occur when the ground level of the quasimolecule (Z, Z, e) is lower than -m/sub e/c^2. In order to find R/sub cr/ the Dirac equation with two Coulomb centers

is considered. By means of a proper choice of coordinates and using the variational principle the problem is reduced to a set of ordinary linear differential equations with singular coefficients. To solve the boundary problem the Riccati equation for the logarithmic derivative matrix was considered. The computations are carried out, and R/sub cr/ is found as a function of the nuclear charges. By virtue of the variational principle the obtained quantity is a sure lower limit for R/sub cr/. (auth)

11048 MICROSCOPIC DESCRIPTION OF COLLECTIVE MOTION IN PF SHELL MODEL. Muether, H.; Allaart, K. (Vrije Universiteit, Amsterdam (Netherlands). Natuurkundig Lab.); Goeke, K. (Oxford Univ. (UK). Dept. of Theoretical Physics); Faessler, A. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik). Nucl. Phys., A; 248: No. 3, 451-464(1 Sep 1975).

Rotational and vibrational excitation in pf shell nuclei are studied by means of the generator coordinate method. The generator coordinates are the pairing energies and the quadrupole moments of constrained Hartree–Bogoliubov states, projected onto good angular momenta and particle numbers. The Kuo interaction and the one modified by McGrory are used. The vibrational character of the yrast energies appears to be produced by mixing prolate and oblate wave functions. Pairing correlations are essential for this mixing. In contrast to the yrast states the excitation energies of the higher states depend strongly on the interaction used. They show good agreement with experiment particularly in the case of ^{48}Ti with the Kuo force. The calculated B(E2) values exhibit a rotational band structure in general, even if the energies look more vibrational. The force dependence of the excitation energies can qualitatively be understood by inspection of the intrinsic energy surface. (NL)

11049 CALCULATION OF COULOMB ENERGIES FOR UNIFORM CHARGE DISTRIBUTIONS OF ARBITRARY SHAPE. Davies, K. T. R.; Sierk, A. J. (Los Alamos Scientific Lab., NM). J. Comput. Phys.; 18: No. 3, 311-325(Jul 1975).

Three distinct surface-integral formulas are derived for calculating the Coulomb energies of uniform charge distributions of arbitrary shape. Of particular interest is an equation obtained by applying Gauss' divergence theorem twice. It is shown that this equation can be simply transformed to another expression which has been widely used for calculating Coulomb energies, with this derivation implying a third formula. The three formulas are also expressed in cylindrical coordinates for charge distributions possessing axial symmetry. For such shapes, numerical studies are presented showing the computational times and errors involved in calculating the Coulomb energies and generalized forces using Gaussian-Legendre quadrature formulas. It is shown that the double-divergence-derived formula is faster and more accurate than the other two surface-integral formulas and other formulas used in the literature. (auth)

11050 ELECTRON EXCITATION OF ISOSCALAR NUCLEAR TRANSITIONS. Tassie, L. J. (Australian National Univ., Canberra. Dept. of Theoretical Physics). Nucl. Phys., A; 248: No. 3, 465-476(1 Sep 1975).

An infinite set of energy-weighted sum rules is given for longitudinal electric excitation of isoscalar nuclear transitions by inelastic electron scattering. The form factor and transition density for excitation of an arbitrary eigenstate of the nucleus are given as sums over the sum rules, and, for a particular choice of the operators in the sum rules, are given by series of which the first terms are the same as the results of the hydrodynamic model. (NL)

11051 MODEL CALCULATIONS FOR ^{50}Ca AND THE CONVERGENCE PROPERTIES OF THE PERTURBATION EXPANSION FOR THE EFFECTIVE INTERACTION. Barrett, B. R.; Weng, W. -T. (Arizona Univ., Tucson (USA). Dept. of Physics); Osnes, E. (Oslo Univ. (Norway). Fysisk Institutt); Richert, J. (Centre National de la Recherche Scientifique, 67- Strasbourg (France). Centre de Recherches Nucleaires). Nucl. Phys., A; 248: No. 3, 429-440(1 Sep 1975).

Using the results of the "exact" shell model calculation of McGrory et al. for the Ca isotopes as "experimental data", model calculations for ^{50}Ca were performed in order to test the convergence properties of different perturbation schemes for computing the effective interaction. Three different model spaces were investigated: (i) $p_{\frac{1}{2}}$, (ii) $p_{\frac{1}{2}} + p_{\frac{3}{2}}$ and (iii) $p_{\frac{1}{2}} + p_{\frac{3}{2}} + f_{\frac{5}{2}}$. In the $p_{\frac{1}{2}}$ model space three different first-order interactions were used in computing the perturbation expansion for the effective interaction through third order: (a) V is equivalent to $(G + G_{3p-1h})_{KB}$, (b) a standard G-matrix computed from V in (a), and (c) a doubly partitioned G-matrix computed from V by excluding excitations into the $p_{\frac{1}{2}}$ level. The results for the doubly partitioned G yielded the best convergence through third order and the best agreement with the J = 0, T = 1 ground state of ^{50}Ca. (NL)

11052 VALIDITY OF CONSTRAINED VARIATIONAL METHODS FOR DENSE NEUTRON MATTER. Pandharipande, V. R. (Illinois Univ., Urbana (USA)). Nucl. Phys., A; 248: No. 3, 524-531(1 Sep 1975).

The energies of fictitious Boltzmann particles of neutron mass interacting via simple Yukawa potentials are calculated by the method of constrained variation in the lower order (LOCV) and hypernetted chain (HNCV) approximations. Comparison of calculated energies with exact Monte Carlo results indicates that LOCV may overestimate the liquid energy by approximately 10% while it could be accurate to within approximately 5% in the solid phase. The liquid energies in the HNCV approximation are almost identical with the Monte Carlo energies, suggesting that it is a very good approximation for the neutron matter problem. A comparison with the results obtained by other lowest order methods shows that the constrained variation is probably the most reasonable approximation scheme to treat neutron matter with realistic interactions. The shortcomings of LOCV are also stated. (NL)

11053 VARIOUS DERIVATIONS OF THE ENERGY DEPENDENCE OF THE EMPIRICAL OPTICAL POTENTIAL. Passatore, G. (Genoa Univ. (Italy). Istituto di Scienze Fisiche). Nucl. Phys., A; 248: No. 3, 509-517(1 Sep 1975).

The predictions of the energy dependence of the real part of the empirical potential implied by the formulations based on nuclear reaction theories and on the multiple scattering approach are compared. The recent data on the nucleon-nucleon forward scattering amplitude obtained from phase-shift analyses, direct measurements and dispersions relations are used. The meaning of the local expression obtained in the multiple scattering formalism is discussed and it is shown that its implications agree with those derived by the nuclear-theories approach. (NL)

PHYSICS (RADIATION AND SHIELDING)

Radiation Physics

Refer also to abstracts 9318, 9944, 10234, 10247, 10255, 10261, 10277, 10334, 10613, 11084, and 11087.

11054 (COO-881-443) EFFECT OF DISPERSION ON WAKE BOUND ELECTRON STATES IN METALS. Day, M. H. (Wisconsin Univ., Madison (USA). Dept. of Physics). Feb 1975. 13p. Dep. NTIS $4.00.

Using a dispersive dielectric function for the response of the electron gas, the induced potential along the path of a fast ion in a metal is calculated. From this, geometrical and binding information for the states of electrons which this potential may bind are determined. (auth)

11055 (EUR-5273d-e-f(Vol.2), pp 627-662) INTERNATIONAL NEUTRON DOSIMETRY INTERCOMPARISON. Goodman, L. J. (Columbia Univ., New York); Colvett, R. D.; Caswell, R. S. Mar 1975.

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F.R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

Fourteen groups of scientists, from six countries, performed measurements to determine the separate neutron and photon (x- and gamma-ray) tissue kermas in free air for four energies of monoenergetic neutrons, 15.5, 5.5, 2.1, and 0.67 MeV, and for a source of fission neutrons, ^{252}Cf. For the two highest energies, measurements were also made to determine the separate absorbed doses in tissue of neutrons and of photons at three depths in a large water phantom. (auth)

11056 (EUR-5273d-e-f(Vol.2), pp 663-680) DOSIMETRY INTERCOMPARISONS BETWEEN FAST NEUTRON RADIOTHERAPY FACILITIES. Almond, P. R. (M.D. Anderson Hospital and Tumor Inst., Houston, TX); Smith, A. R.; Smathers, J. B.; Otte, V. A. Mar 1975.

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F. R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

Neutron dosimetry intercomparisons have been made between M. D. Anderson Hospital and Tumor Institute, Naval Research Laboratory, University of Washington Hospital, and Hammersmith Hospital. The parameters that are measured during these visits are: tissue kerma in air, tissue dose at depth of dose maximum, depth dose, beam profiles, neutron/gamma ratios and photon calibrations of ionization chambers. A preliminary report of these inter-comparisons is given including a comparison of the calculation and statement of tumor doses for each institution. (auth)

11057 (EUR-5273d-e-f(Vol.2), pp 681-731) CALCULATIONS OF THE TRANSPORT OF FAST NEUTRONS (less than or equal to 50 MeV) THROUGH MATTER. Alsmiller, R. G. Jr. (Oak Ridge National Lab., TN). Mar 1975.

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F.R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

The data and methods which are available to carry out coupled neutron-photon transport calculations at neutron energies less than or equal to 50 MeV are discussed. The emphasis is on those problems involving the higher neutron energies (less than or equal to 15 to 20 MeV) and on those problems requiring charged-particle spectra produced by neutron-nucleus collisions. Much of this discussion, therefore, is centered about the code HETC which is capable of solving such problems. Calculated results on absorbed dose, LET spectra, cell-survival probabilities, OER's, and RBE's for several neutron spectra incident on a tissue-equivalent phantom are presented, and some comparisons between calculated results and experimental data are given. A few comparisons are also given for LET spectra, OER's, and RBE's for photons, neutrons, negatively charged pions, protons, and alpha particles incident on a tissue phantom. All of the cell-inactivation calculations were carried out using the model of Katz et al. and parameters appropriate to T-1 kidney cells. 16 fig, 8 tables, 64 refs. (auth)

11058 (EUR-5273d-e-f(Vol.2), pp 733-740) SPECIAL INHOMOGENEITY EFFECTS FOR NEUTRON IRRADIATION OF THE LUNG AND HEAD. Boehm, J. K.; Hehn, G.; Kramer, H.; Pfister, G.; Prillinger, G.; Stiller, P. (Univ., Stuttgart). Mar 1975.

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F.R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

For a 14 MeV neutron therapy facility the effects of inhomogeneities occurring in real irradiation of the lung and head have been studied in detail with the computer. The main calculation methods applied were the S_N-approximation and the Monte Carlo method. Neutron fields with beams of circular and rectangular cross sections have been taken into account. The influence of different material layers with different atomic composition and densities on the neutron field had been studied and compared with the results of the homogeneous phantom and Co-60 dose curves. The comparison was done with the absorbed dose showing the relative differences in the mainly perturbed regions within and outside the inhomogeneity. For comparison the same problem has been treated for irradiations with Betatron-electrons. The combined application of beams of thermal reactor neutrons and boron pharmaca for tumor treatment in the head has been studied and compared with the application of fast neutrons. (auth)

11059 (EUR-5273d-e-f(Vol.2), pp 741-755) SIMULATION OF THE LOCAL AND TIME DEPENDENT RADIATION REACTIONS FOR NEUTRON IRRADIATION. Hehn, G.; Pfister, G.; Prillinger, G.; Stiller, P. (Univ., Stuttgart). Mar 1975.

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F.R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

Since the Relative Biological Effectiveness (RBE) of neutrons depends strongly on the neutron energy, the energy spectrum must be taken into account additionally to the absorbed dose of neutrons. Based on real spectra of neutrons from 14 MeV- and cyclotron therapy units the local dependence of these spectra is shown in a homogeneous standard man phantom. The radiation reactions in living tissue can be determined by means of the energy dependent RBE-values. The results show that the depth dependence of the radiation reaction curve is better than the depth dose curve, but the beam profile is broadened to some extent. For detailed treatment of these effects, the energy distribution of primary recoils was evaluated, along with their equilibrium spectrum and their energy dose as a function of Linear Energy Transfer (LET). For simulating the time dependent effects, the cybernetic model of Pohlit was used. (auth)

11060 (EUR-5273d-e-f(Vol.2), pp 757-782) NEUTRON COLLIMATOR CALCULATIONS. Gruenauer, F. (Gesellschaft fuer Strahlen- and Umweltforschung mbH, Munich). Mar 1975.

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F.R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

A quantitative assessment of the effectiveness of a neutron shielding is normally done by determining the attenuation of the tissue-kerma by the presence of the shielding. From the biological point of view another factor is of even more importance: the attenuation of the biologically effective dose in tissue ("RBE-dose"). The spatial distribution of this quantity has been calculated for a variety of shields and neutron collimators. One of the results of these calculations is that the axial RBE depth-dose in a phantom is similar to the energy depth-dose whereas the RBE-dose profile within the penumbral region differs significantly from the energy dose profile. Investigations about the distance between the collimator and the phantom — using a fixed focus-to-skin distance — were carried out to determine its influence on the dose profiles in various depths of the phantom. Neutron collimator and shield activation induced by the $Fe^{56}(n,p)Mn^{56}$-process was studied. Using a beam shutter and at a neutron dose rate of 30 rad/min during irradiation the gamma dose rate in front of the collimator after shutdown was calculated to be at most 20 mrad/h. Neutron and gamma ray spectra as well as dose profiles inside of homogeneous phantoms are described in some detail for the therapy facilities at the German Cancer Research Centre (DKFZ) in Heidelberg and at the TNO in Rijswijk. Dose profiles of the radiation facility at TNO are compared with data measured by Broerse et al.. Calculations of the stray neutron field and the gamma ray field were made for a simple model irradiation room. 16 figs, 3 tables.

11061 (EUR-5273d-e-f(Vol.2), pp 783-794) MONTE CARLO CALCULATIONS OF A COLLIMATOR FOR FAST NEUTRON THERAPY. Schlegel, D.; Dietze, G. (Physikalisch-Technische Bundesanstalt, Brunswick). Mar 1975.

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F.R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

A Monte Carlo program is presented which computes neutron spectra near the exit of such a collimator. The neutron source is assumed to be a point source which emits monoenergetic neutrons. The basic assumptions on the collimator geometry are shown. Several results using 14 MeV neutrons and various geometrical collimator configurations are discussed. 5 figs. (auth)

11062 (EUR-5273d-e-f(Vol.2), pp 795-809) CLINICAL DOSIMETRY OF CALIFORNIUM-252. Nagarajan, P. S.; Iyer, P. S. (Bhabha Atomic Research Centre, Bombay). Mar 1975.

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F.R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

Californium-252, a source of fission neutrons, is being investigated as a potential replacement of radium and other gamma emitters in radiation therapy. The advantages of the source include favorable oxygen enhancement ratio, absence of gaseous radioactive daughter products and the requirement of only small quantities of source to produce dose rates usually required for such treatments. This paper (i) presents the results of dosimetric computations for intracavitary applications of californium sources and thermalized-neutron induced activities consequent to such applications and (ii) suggests a system of loadings of californium sources based on the conventional radium loadings for cancer of cervix taking into account the effects of dose rates and LET of dose components. The relative biological effectiveness of californium neutrons is estimated to be 6.2 for the suggested loadings which are similar to the standard radium loadings. Typical isoeffective dose curves are illustrated. Over the volume of interest the ratio of neutron to gamma dose rate (1.5 : 1) and the RBE are found to be constant. Beyond the volume of interest the neutron to gamma ratio decreases implying a reduced RBE for normal tissue. It is found that 20 radioisotopes are produced in both bone and tissue and the total maximum activity in the pelvis for a typical application is nearly 2 μCi. In bone, which is at an average distance of 10 cm from the sources, the high LET dose from the (n,p) and (n,α) reactions due to thermalized neutrons is found to be 14% of the fast neutron dose. However, in tissue over the volume of interest, this component is negligible. (auth)

11063 (EUR-5273d-e-f(Vol.2), pp 825-836) ENERGY DISTRIBUTION OF D-T NEUTRONS IN PLEXIGLASS AT THE NEUTRON THERAPY FACILITY IN HAMBURG-EPPENDORF. Bormann, M.; Magiera, E.; Schmidt, R.; Sittig, R. (Univ., Hamburg). Mar 1975. (In German)

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F.R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

The energy distribution of fast neutrons was measured in lucite in 8 different depths with the activation method using threshold detectors. Six foils consisting of different detector materials were used, with thresholds of the corresponding neutron induced reactions between 4 and 12 MeV. The induced radioactivities were detected with a 3'' x 3'' NaI-well-crystal scintillation counter. The initial activities of the foils were normalized by using a reference foil. With the help of well-known excitation functions we computed the energy distributions. These spectra are compared with neutron spectra measured with a recoil-proton telescope. A special effort was made to measure also the flux of slow neutrons present in the spectra. 7 figs, 1 table (auth)

11064 (EUR-5273d-e-f(Vol.2), pp 837-863) ANALYTICAL STUDY OF IONIZING SECONDARY EVENTS ALONG α TRACKS RECORDED IN IONOGRAPHIC EMULSIONS. Ndocko Ndongue, V. B.; Wittendorp, E.; Rechenmann, R. V. (Univ., Strasbourg). Mar 1975.

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F.R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

Ionizing secondary events are distributed along α trajectories ($R_\alpha \leq 100\ \mu$m) recorded in nuclear emulsion. Results obtained by means of theoretical approaches proposed by different authors on the ionization of atoms and on the recoil of nuclei have been compared with our experimental data. In the case of energetic δ rays, satisfying results have been obtained by using a mixed treatment combining a formula proposed by Fano and a specific expression for strongly bound electrons given by Merzbacher et al. The theoretical yields of recoil H-nuclei were calculated by means of a treatment of Lindhard et al. After a short recall of the methodology which allowed the obtention of our experimental data, we give the experimental results obtained with the L4 emulsion at different gelatine concentrations. These data are compared with corresponding theoretical values. It appears that all the results can be interpreted on the basis of our working hypothesis, i.e. that the protuberances distributed along α particle trajectories are due to short tracks of electrons and protons ejected by the incident particle. (auth)

11065 (EUR-5273d-e-f(Vol.2), pp 895-905) RESULTS IN THE DETERMINATION OF NEUTRON SPECTRA FROM ACTIVATION MEASUREMENTS IN THE VICINITY OF NEUTRON GENERATORS. Hrabovcova, A.; Nikodemova, D.; Minarik, F. (Inst. fuer Arbeitshygiene und Berufskankheiten, Bratislava). Mar 1975. (In German)

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F.R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

Results are reported on the measurements of the energy distribution of fast neutrons in the primary beam of the neutron generator ^{3}H(d,n)^{4}He using threshold detectors. The suitability of the RDMM method for the determination of spectra from activation measurements was tested. The method was used in two measurements of the neutron spectra in the neutron generator. The calculated doses for the homogeneous tissue-equivalent cylindrical phantom were used for the determination of the dependence of the dose on the penetration depth in the phantom for the measured spectra. (tr-auth)

11066 (EUR-5347e) SIMULATION OF TRANSPORT EQUATIONS WITH MONTE CARLO. Matthes, W. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1975. 39p. Dep. NTIS (US Sales Only) $5.00. EUR FB 125,-.

The relation between the transport equation and the Monte Carlo game used for its solution is explained. The introduction of artificial particles carrying a weight provides high flexibility in constructing many different games for the solution of the same equation. This flexibility opens a way to construct a Monte Carlo game for the solution of the adjoint transport equation. Emphasis is laid on giving a clear understanding of what to do and not on the details of how to do a specific game. (auth)

11067 (FRNC-TH-561) MONTE-CARLO SIMULATION OF THE EFFECT OF COMPENSATING CONES (FILTERS) ON THE DIRECTIONAL ENERGY SPECTRUM OF A 25 MeV PHOTON BEAM. Jitao, S. (Toulouse-3 Univ., 31 (France)). 1975. 72p. (In French). INIS.

Thesis.

The calculation methods used for high energy particles (about 1 KeV to 100 MeV) are given. The 25 MeV electron transport in a three-laminar system is then simulated. The photons produced by electrons in this system are filtered by a variable thickness of lead (compensating cone). The calculation is effected so far as they are out of the cone. Results obtained are given, particularly the energetic and angular spectra of photons crossing the filter. The attenuation law for these photons in semi-infinite systems made of lead, copper or aluminium is also given. (FR)

11068 (UCRL-76904) DESIGN CRITERIA FOR PHANTOMS FOR CALIBRATION OF EXTERNAL DETECTORS FOR THE IN-VIVO ASSAY OF PLUTONIUM. Dean, P. N.; Griffith, R. V.; Anderson, A. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Jun 1975. 5p. (CONF-751205-1). Dep. NTIS $4.00.

From IAEA international seminar on diagnosis and treatment of incorporated radionuclides; Vienna, Austria (8 Dec 1975).

Problems associated with calibration and standardization of existing phantoms for measurement of plutonium isotopes in the lungs are discussed. The efforts of the "Intercalibration Committee for Low-Energy Photon Measurements" to design a standard phantom are described. Two approaches to the design are described and design details are given. (GHT)

11069 RADIATION FIELD QUANTITIES OR DOSE QUANTITIES IN RADIATION PROTECTION. Wagner, S. (Physikalisch-Technische Bundesanstalt, Braunschweig (F. R. Germany)). Atomkernenergie; 25: No. 4, 303-306(1975).

2 figs.; 16 refs.

Misunderstandings of the conceptual difference between physical quantities on the one hand and their units on the other hand have for a long time delayed the formation of clear concepts for dosimetry and the rigid definition of physical quantities, thus masking the causal sequence from radiation source over radiation field to radiation effect. The physical quantities characterizing each stage are given with reference to the correlations between them. It is shown that dose quantities (exposure, absorbed dose, dose equivalent) serve best the aims of radiation protection work.

Special consideration is given to the case of neutron radiation which is complicated by the necessary introduction of quality factors. The relation between neutron fluence and maximum dose equivalent in an irradiated body might suggest the determination of field quantities instead of dose quantities. But this can only be a practical advantage if additional information on the spectral distribution of neutrons is available. In view of the fact that radiation protection guides are given in terms of dose equivalent and that photon radiation is generally the predominant hazard and mostly presents the main contribution in mixed radiation fields, the common base for the assessment of radiation hazard should remain in dose quantities. (auth)

11070 INFLUENCE OF AIR CAVITIES ON THE DOSE DISTRIBUTION OF HIGH-ENERGY ELECTRON BEAMS. Nuesslin, F. (Medizinische Hochschule, Hanover). Phys. Med. Biol.; 20: No. 5, 728-734(Sep 1975).

A Lucite phantom containing cylindrical air cavities was irradiated with high-energy electrons from a betatron. By measuring depth-dose curves, the relative enhancement in electron fluence adjacent to the cavity on the side opposite to the beam entrance was determined as a function of the initial electron energy, the dimensions of the cavity and its depth in the phantom. The enhancement factor was found to be critically dependent on energy, the height of the cavity and its depth in the phantom, but to a lesser extent on its diameter. The experimental results have been compared with calculations based on multiple scattering theory. (auth)

11071 EMPIRICAL EQUATION FOR THE PHOTOELECTRIC CROSS SECTION. Diffey, B. L. (Kent and Canterbury Hospital, Eng.). Int. J. Appl. Radiat. Isot.; 26: No. 8, 492-493(Aug 1975).

An empirical method which relates the photoelectric cross section to energy in the range 10 keV to 1 MeV has been developed using values obtained from Grodstein's compilation as data points. For each material, the natural logarithm of the photoelectric cross-section in barns per atom for elements (or in barns per molecule for compounds and mixtures), is expressed as a polynomial of the fifth degree, in which the independent variable is the natural logarithm of the photon energy in keV. A selection of the polynomial coefficients obtained by this method is listed. (UK)

11072 RBE VALUES FOR MEGAVOLTAGE X RAYS. Greene, D.; Hendry, J. H.; Massey, J. B. (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Br. J. Radiol.; 48: No. 574, 875(Oct 1975).

The RBE value of 1.0 for clinical tolerance of megavoltage x rays as compared to 250 kVp x rays (Hornsey, S., and Silvester, A., 1974, Br. J. Radiol., Vol. 47, 670) shows a smaller discrepancy with the older values than these authors suggest. These older values were subsequently revised (Greene, D., Massey, J. B., and Meredith, 1962, Br. J. Radiol., Vol. 35, 721), by taking into account changes in both the orthovoltage and megavoltage dosimetry, to give a comparable RBE value of 0.9. Uncertainties in basic dosimetry would still contribute an uncertainty of ±3 per cent to either of these values. Published evidence both supporting and contradicting the RBE value of 1.0 for mouse intestinal crypt survival is also briefly discussed. (UK)

11073 X-RAY COMPTON PLASMON SCATTERING BY SOLIDS. Pimpale, A. (Southampton Univ., Eng.); Mande, C. J. Phys., C (London); 8: No. 15, 2463-2472(7 Aug 1975).

A study of self-energy corrections to the RPA dielectric function shows the possibility of a new x-ray scattering process (XCPS) in which both a plasmon and an electron-hole pair are created simultaneously. Appropriate energy-momentum conservation equations are formulated and solved. The differential scattering cross section for XCPS is obtained in a simple way and numerical calculations are presented for the case of CrK_{β_1} radiation incident on beryllium. The XCPS lineshape is asymmetric and consists of two components arising from the RPA dielectric function and the plasmon singularity of the self-energy function. The total intensity under XCPS is about 10 per cent of that under the pure plasmon scattered spectrum. (auth)

11074 STOPPING CROSS SECTIONS FOR HELIUM AND HYDROGEN IN H_2, N_2, O_2, AND H_2S (0.3–2.5 MeV). Langley, R.A. (Sandia Laboratories, Albuquerque, New Mexico 87115). Phys. Rev. B 12: No. 9, 3575-3583 (1 Nov 1975).

Ion backscattering has been developed recently as a microanalytical technique for depth microscopy and mass analysis in solids. To establish an absolute depth scale in such studies, the energy loss rate of the ion in the constituents of the solid must be accurately measured. Hydrogen, nitrogen, oxygen, and sulphur are often important components of thin solid films; therefore, it is of interest to measure the stopping cross sections of H_2, N_2, O_2, and H_2S. A new technique has been developed to accomplish the measurement of the stopping cross sections of high-energy ions (>300 keV) in gases. The technique minimizes end-effect problems by passing the ions through a long gas cell and eliminates count-rate difficulties by detecting these ions after they have scattered from a thin Au film. This technique has been used to obtain stopping cross sections for 0.3–2.5-MeV protons and He ions in H_2, N_2, O_2, and H_2S to an uncertainty of less than ±2%. The first stopping cross sections for S are derived by means of Bragg's rule and found to be appreciably greater than currently available theoretical or empirical values. (auth)

11075 PHOTON ATTENUATION IN COMPUTED TOMOGRAPHY. McCullough, E.C. (Department of Diagnostic Roentgenology, Mayo Clinic/Foundation, Rochester, Minnesota 55901). Med. Phys. 2: No. 6, 307-320 (Nov 1975).

The analysis and understanding of results of computed tomography (CT) require an understanding of photon attenuation in matter. The high sensitivity and resolution of these devices coupled with the use of a polychromatic photon source require a level and breadth of understanding about photon attenuation not usually required in any particular subspecialty of radiological physics. With this goal in mind, a discussion of narrow-beam photon attenuation in matter is given and related to those problems currently underway in the field of computed tomography. Measurements and calculations of tissue properties are presented. Calculations of descriptive quantities relevant to polychromatic source attenuation and CT scanning are described and presented. (auth)

11076 BREMSSTRAHLUNG REDUCTION BY DIELECTRIC TRAPPING. Wade, J.J.; Hollis, D.L. (Department of Electrical Engineering, The University of Alabama, University, Alabama 35486). J. Appl. Phys. 46: No. 12, 5158-5162 (Dec 1975).

A mathematical model is used to analyze the effects of trapped negative charges in a dielectric absorber on bremsstrahlung production from low to moderate energy electrons. Significant changes in the bremsstrahlung spectra are predicted when the induced field due to trapped electrons is sufficiently large. Experiments with Tl-204 and an electron accelerator as electron sources indicate that bremsstrahlung reduction does occur, although the effect is limited by radiation-induced conductivity. (auth)

11077 A THEORY OF LOW-ENERGY-ELECTRON DIFFRACTION FOR SIMPLIFYING OVERLAYER CALCULATIONS. Shen, A.P. (Bartol Research Foundation of The Franklin Institute, Swarthmore, Pennsylvania 19081). Phys. Rev. B 12: No. 10, 4223-4230 (15 Nov 1975).

The effect of the deposition of an overlayer on low-energy-electron-diffraction patterns is described by a Green's-function method which calculates the Green's function associated with the surface before the deposition of an overlayer. The theory treats the clean-surface reflection coefficients as input information. A muffin-tin-potential model is assumed for the two-dimensionally periodic overlayer. The exact reflection coefficient of an elastically scattered beam from the overlayer-substrate system is expressed in terms of structure constants and phase shifts of the adsorbate, as well as the reflection coefficients of diffracted beams from the clean substrate. With known clean-surface reflection coefficients, the overlayer problem is similar to that of a monolayer crystal, the structure constants and the phase shifts of the adsorbate only are necessary to be calculated. Thus this theory offers a simpler way in dealing with complicated overlayer low-energy-electron-diffraction problems. (auth)

11078 COMPUTER CODE FOR DEPTH DISTRIBUTION OF ENERGY DEPOSITION BY HEAVY ION BOMBARDMENT. Manning, I.; Mueller, G. P. (Naval Research Lab., Washington, D. C. (USA)). Nucl. Eng. Des.; 33: No. 1, 78-81(Aug 1975).

For bombardment by a heavy-ion beam, a FORTRAN computer code has been written which yields the distribution of energy deposited into elastic atomic collisions as a function of penetration depth. The aim has been to develop a simple package, inexpensive to run, that could be operated with little or no previous experience. The calculation is based on an approximation of Kulcinski et al., refined to include the theory of Lindhard et al. which accounts for cascade energy loss to electronic collisions. Range calculations are obtained from the code of Johnson and Gibbons, which this code incorporates. The results of the code are compared with existing calculations of Brice and of Sigmund et al. (NL)

11079 RADIATION OF ELECTRONS TRANSMITTED THROUGH A CRYSTAL. Vorobiev, A. A.; Kaplin, V. V.; Vorobiev, S. A. (Tomskij Politekhnicheskij Inst. (USSR). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). Nucl. Instrum. Methods; 127: No. 2, 265-268(1 Aug 1975).

The electromagnetic radiation of electrons which happen to become bound to lattice rows during their transmission through a crystal is investigated. Simple estimates of the angular distribution and frequency of radiation for fast electrons captured by ⟨100⟩ NaCl atomic rows are obtained. The frequency of the radiation varies within a wide range including the visible spectral region. This gives an opportunity to detection of the β-particles contrary to Cherenkov radiation which has a low-energy limit. (NL)

Radiation Protection Standards

Refer also to abstracts 9504, 9513, 9946, and 11068.

11080 4TH GERMAN SYMPOSIUM ON ATOMIC ENERGY LEGISLATION: REORGANIZATION OF RADIATION PROTECTION. von Pander, J. Energiewirtsch. Tagesfragen; 25: No. 7, 313-314(Jul 1975). (In German).

From 4th German symposium on atomic energy legislation; Goettingen, F. R. Germany (26 May 1975).

After those concerned had already presented in the spring their arguments regarding the rewriting of StrlSchVO (regulation for the protection against injuries due to ionizing radiations) the StrlSchVO-draft dated 14th March 1975 was discussed on a scientific level on the occasion of the symposium before the end version would have its final reading in the Bundesrat. The results are to be made available for drawing up the final draft. (GE)

11081 USE OF ANIMAL DATA IN DERIVATION OF STANDARDS. Brues, A. M. (Argonne National Lab., IL). Health Phys.; 29: No. 4, 521-524(Oct 1975).

From proceedings of the second Los Alamos life sciences symposium; Los Alamos, NM, USA (22 May 1974).

Some of the more important concepts used in the derivation of radiation standards, and problems in their application, are reviewed. In particular, the application of various models for carcinogenesis and the influence of differing cell susceptibilities for various sizes of animals are considered. (auth)

11082 RADIATION PROTECTION CONCEPTS: PROPOSAL FOR A NEW CRITERION. Failla, L. (CNEN, Rome). Health Phys.; 29: No. 5, 723-728(Nov 1975).

The basic concepts, on which current radiation hazard evaluation are based, are summarized. An additional principle is considered namely that of assessing the use to which the radiation source under consideration is to be put. The difficulties of knowing the different uses of radioisotopes and considering the various possibilities of their contaminating the environment are discussed together with the possibility of formulating a mathematical model adaptable to different uses. (UK)

Radiation Source Calibration and Standardization

Refer also to abstract 11063.

11083 (EUR-5273d-e-f(Vol.2), pp 939-953) USE OF SMALL $MnSO_4$-BATHS FOR CALIBRATION OF NEUTRON SOURCES. Alves, R. N. (Instituto de Radioprotecao e Dosimetria, Guanabara, Brazil); Reis, D.C.C.; Fernandes, S. M.; Gruenauer, F.; Burger, G. Mar 1975.

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F.R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

The uncertainty of neutron source strength determination by means of the Mn^{55}-activation in aqueous $MnSO_4$-baths is principally determined by two kinds of errors: the uncertainties of the correction factors to be applied for all kind of fast, intermediate and thermal neutron losses by nuclear reactions and by leakage; the experimental errors in determining the Mn^{55}-concentration and finally the Mn^{56}-saturation activation. With decreasing source strength the experimental error increases and determines often the uncertainty of the result. The situation can be improved by decreasing the bath size, which increases the specific activation. However, at the same time the neutron-loss correction and its uncertainty increases. Systematic experimental studies have been performed on Mn^{55}-activation in different-sized spherical and a large size cylindrical bath, with varying Mn^{55}-concentration, using AmBe-neutron sources with varying source strengths. The Mn^{56}-activity is measured by a NaJ(TL) crystal dipped into the bath. The experimental results of bath activation were compared with computer data based on calculations with the one dimensional multigroup code ANISN. A quantitative error analysis was applied to determine the crucial uncertainties of the technique as a function of neutron source strength. 7 figs. (auth)

11084 (EUR-5273d-e-f(Vol.2), pp 979-1003) NEUTRON AND GAMMA RADIATION FIELD OF A DEUTERIUM GAS TARGET AT A COMPACT CYCLOTRON. Schraube, H.; Morhart, A.; Gruenauer, F. (Gesellschaft fuer Strahlen- und Umweltforschung mbH, Munich). Mar 1975.

From 2nd symposium on neutron dosimetry in biology and medicine; Neuherberg/Munich, F.R. Germany (30 Sep 1974).

In proceedings of second symposium on neutron dosimetry in biology and medicine. II.

Investigations in the uncollimated radiation field produced by the deuterium pressurized gas target at the compact cyclotron at the German Cancer Research Centre (DKFZ) in Heidelberg were continued. In these studies dose rate and spectral distribution of fast neutrons were of particular interest as regards their use in depth therapy as well as the accompanying gamma component. The energy of the deuterons from the cyclotron was about 11 MeV, the maximum energy of the reacting deuterons after passing the target foil was about 10.6 MeV. For various operating conditions of the target, i.e. varying gas pressures and bombarding energies, spectral distribution of fast neutrons was calculated at various distances from the target. On the basis of these spectral distributions several integral quantities were determined, e.g. Kerma in tissue, in ionization chambers, as well as mean cross-sections for some reactions used for neutron detection. In order to prove the calculations spectral flux densities for different target pressures were measured at a distance of 1 meter from the target foil with the aid of a telescope-spectrometer. By use of two ionization chambers, of a tissue-equivalent- and of a C/CO_2-chamber, neutron and gamma dose rate were determined. Power tests up to a beam current of about 70 μA have demonstrated that, at least up to this current, the dose rate is increasing linearly and that the neutron spectrum does not change very significantly. On the basis of experiences hitherto obtained it is reasonable to assume that the durability of the target foil is of at least 200 μAh. (auth)

11085 IMPROVED METHOD OF DATA COLLECTION FOR $4\pi\beta-\gamma$ COINCIDENCE MEASUREMENTS. Smith, D. (National Physical Lab., Teddington (UK). Div. of Radiation Science). Metrologia; 11: No. 2, 73-77(Jun 1975).

2 figs.; 5 refs.

A method of data collection for the determination of absolute disintegration rates by the $4\pi\beta-\gamma$ coincidence technique is described, which gives nearly an order of magnitude smaller variance, for a given total counting time, than conventional methods. It is applicable when the β counter output is proportional to the β particle energy. The principle, which is demonstrated for ^{134}Cs, is to record the amplitudes of all the β pulses, followed by integration over variable limits. Expressions for dead time and resolving time corrections are derived. (auth)

11086 EXTENSION OF THE $4\pi\beta-\gamma$ COINCIDENCE TECHNIQUE: TWO DIMENSIONAL EXTRAPOLATION. Smith, D.; Stuart, L. E. H. (National Physical Lab., Teddington (UK). Div. of Radiation Science). Metrologia; 11: No. 2, 67-72(Jun 1975).

9 figs.; 9 refs.

As an extension of the $4\pi\beta-\gamma$ coincidence technique, it is shown that for some radionuclides, the β count rate should be expressed as a function of at least two observed β efficiencies, and that the absolute disintegration rate can be obtained by a simultaneous extrapolation to 100% efficiency in the two or more dimensions. Measurements on ^{57}Co and ^{134}Cs are described as examples. For these nuclides, the separated efficiency functions are shown to be linear in theory as well as in practice. Thus a major source of systematic uncertainty in efficiency extrapolation, that due to the unknown form of the extrapolation function, is greatly reduced. (auth)

11087 POTENTIAL OF CALIFORNIUM-252 IN RADIOTHERAPY. Hall, E. J.; Rossi, H. (Columbia Univ., New York). Br. J. Radiol.; 48: No. 574, 777-790(Oct 1975).

Californium-252 is a man-made radionuclide (half-life 2.65 years) which emits a mixture of neutrons and γ rays. It is used in radiotherapy as an alternative to radium and extends the potential benefits of neutrons to interstitial and intracavitary applications. Gamma rays account for a variable proportion of the dose (30 to 50%), depending on the source filtration and the distance from the source. Dosimetry is complicated by this mixture of neutrons and γ rays. However, measurements with paired ion-chambers, together with Monte-Carlo calculations, have produced dosimetric data that are adequate for clinical use. Many determinations of the oxygen enhancement ratio (OER) have been reported. At the low dose-rates characteristic of interstitial implants, the OER is about 1.5. This is essentially the figure for fast neutrons alone, since at very low dose-rate the contribution of the γ rays to the biological effect is negligible. As the dose increases, there is a corresponding rise in the OER because the γ ray contribution can no longer be ignored. The OER is likely to be about 1.8 if ^{252}Cf is used in intracavitary treatments and 2.0 if used in acute exposures in devices such as the Cathetron. The relative biological effectiveness (RBE) varies with dose-rate, and with the biological system used to measure it. Radiobiological experiments indicate that 6,000 rads of radium γ rays

in seven days is equivalent to 890 rads of ^{252}Cf neutrons delivered in approximately the same overall time. This figure was suggested some years ago as an interim guide-line until sufficient clinical experience is accumulated. (auth)

11088 MODEL FOR THE CALCULATION OF OUTPUT FOR ELONGATED FIELDS AT NONSTANDARD DISTANCES FOR A 25-MV BETATRON AND FOR RADIOCOBALT TELETHERAPY UNITS. Starchman, D.E. (NEORAD, Massillon Radiation Center, Massillon, Ohio 44646); Golden, R.; Puterbaugh, M.R.; Loeffler, R.K. Med. Phys. 2: No. 6, 333-335 (Nov 1975).

Output-area factors are usually provided only for square fields at one standard distance. To calculate dose for mantle, extended field, total nodal, subtotal body, and total body irradiation, output-area factors are required for a continuous range of shapes and distances. Dose rate measurements have been made for different elongation ratios at various distances with an Allis-Chalmers 25-MV betatron, an AECL Theratron-80 ^{60}Co unit, a Picker C-9 ^{60}Co unit, and a Picker C-10 000 ^{60}Co unit. A model is presented that permits the extension of dose rates and area factors for square fields at one distance to elongated fields at any distance. An illustrative calculation for one of the units is given. (auth)

Shielding Calculations and Experiments

Refer also to abstracts 11061 and 11076.

11089 (CONF-751063-1) SENSITIVITY ANALYSIS DEVELOPMENT AND APPLICATIONS PROGRAM AT ORNL. Oblow, E. M. (Oak Ridge National Lab., Tenn. (USA)). 1975. 47p. Dep. NTIS $5.00.

From specialists' meeting on sensitivity studies and shielding benchmarks; Paris, France (7 Oct 1975).

The cross-section sensitivity analysis program at ORNL is reviewed with emphasis on present computer code capabilities and fast successful applications in the radiation shielding area. The FORSS sensitivity code system is discussed in regard to objectives, methodology, and code specifications. Examples of past shielding applications of FORSS emphasize the success of fine energy grid sensitivity studies and group structure selection, the use of evaluated error file and problem uncertainty estimation, two-dimensional shield sensitivity analysis and integral experiment design for fast reactors, data studies for the LMFBR program related to sodium and iron evaluations and iron data problems in CTR shielding design. Conclusions are drawn about the adequacy of present ENDF/B data files for sodium and iron and the general applicability of sensitivity studies in future design and analysis. 16 figures, 3 tables (auth)

11090 LEAD SHIELDING THICKNESS FOR DOSE REDUCTION OF 7- TO 28-MeV ELECTRONS. Giarratano, J.C.; Duerkes, R.J.; Almond, P.R. (The University of Texas System Cancer Center, M. D. Anderson Hospital and Tumor Institute, Houston, Texas 77025). Med. Phys. 2: No. 6, 336-337 (Nov 1975).

The relative percent dose reduction by lead of 7- to 18-MeV electrons with a Siemens betatron and of 19- to 28-MeV electrons with a Sagittaire linear accelerator has been measured with a thin-wall buildup chamber for 6.3×6.3- and 10.5×10.5-cm field sizes at the chamber position for the normal treatment source-to-skin distance (SSD) of each machine. The thickness of lead necessary to attenuate the open beam by 95–98% was then determined of 7- to 28-MeV electrons. The required thickness of lead to attenuate 95% of the 7- to 28-MeV electron beam ranged from 2.3 to 18 mm for the 6.3×6.3-cm field and from 2.4 to 23 mm for the 10.5×10.5-cm field, respectively. For 98% attenuation, thicknesses from 2.6 to 25.0 mm for the 6.3×6.3-cm field and from 2.8 to 27.5 mm of lead for the 10.5×10.5-cm field were necessary. (auth)

PHYSICS (THEORETICAL)

General

Refer also to abstract 10340.

11091 (CNRS-CPT-75-P-695) STABILITY AND EQUILIBRIUM IN QUANTUM STATISTICAL MECHANICS. Kastler, D. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Jan 1975. 15p. INIS.

From colloquium on non-commutative harmonic analysis; Marseille, France (1 Jul 1974).

A derivation of the Gibbs Ansatz, base of the equilibrium statistical mechanics is provided from stability requirements, in technical connection with the harmonic analysis of non-commutative dynamical systems. By the same token a relation is established between stability and the positivity of Hamiltonian in the zero temperature case. (FR)

11092 (CONF-720133-P10) IV BRAZILIAN SYMPOSIUM ON THEORETICAL PHYSICS, RIO de JANEIRO, BRAZIL, 4 JANUARY 1972. Volume X. Schwartz, B. B.; Tosi, M. P.; Nussenzveig, H. M.; de Gennes, P. G. (Massachusetts Inst. of Tech., Cambridge (USA). National Magnet Lab.; Messina Univ. (Italy). Instituto di Fisica; Rochester Univ., N.Y. (USA). Dept. of Physics and Astronomy; College de France, 75 - Paris). 1972. 105p. Dep. NTIS (US Sales Only) $8.25.

Separate abstracts were prepared for two of the papers in this volume. The remaining two, on simple metals and quantum optics, were not within the subject scope of NSA. (RWR)

For abstracts of individual papers see: 9185 and 10345.

11093 (IN-2P3-CF-74-1, pp 1-27 (Pt.10A)) QUANTUM MECHANICS AND LOCAL THEORIES OF HIDDEN VARIABLES: RECENT EXPERIMENTAL TESTS. Mittig, W. [nd]. (In French)

From scientific meeting of the Tandem accelerators users; Mont-Sainte-Odile, France (15 May 1974).

In scientific meeting of the Tandem accelerators users. (Institut National de Physique Nucleaire et de Physique des Particules, 75-Paris (France)).

Experiments allowing quantum mechanics conservation to be tested for the cases where the Bell inequality implies differences are discussed (Compton scattering, polarization correlation for two photons for an atomic cascade). A new experiment is presented involving non-zero mass particles and using proton-proton low energy scattering. The proton beam scattered by a hydrogen target; a coincidence measurement is effected for the polarization of the two protons outgoing in coincidence at 45 deg in the laboratory and a second scattering at 50 deg on a carbon target is used for analyzing the polarization state. The experimental results reject the Bell inequality and are in good agreement with quantum mechanics. (FR)

11094 (JINR-E2-9161) "NEAR TO MINIMAL" CANONICAL REALIZATIONS OF THE LIE ALGEBRA C_n. Havlicek, M.; Lassner, W. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. Dep. NTIS (US Sales Only) $4.50.

It is proved that canonical realizations of the Lie algebra C_n in the quotient division ring $D_{2(2n-2)}$ of the Weyl algebra $W_{2(2n-2)}$ in 2n-2 quantum canonical pairs are, in a definite sense, related to the standard minimal one in $D_{2n}CD_{2(2n-2)}$. Further, in any realization of C_n in $W_{2(2n-1)}$ all Casimir operators are realized by multiples of the identity element. (auth)

11095 (JINR-E2-9182) "TRANSITION PROBABILITY" IN THE STATE SPACE OF A *-ALGEBRA. Uhlmann, A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. Dep. NTIS (US Sales Only) $4.50.

Let ω,ρ be two states of a *-algebra and let one consider representations of this algebra R for which ω and ρ are realized as vector states by vectors x and y. The transition probability $P(\omega,\rho)$ is the supremum of all the numbers $|(x,y)|^2$, where one runs through all such realizations. One derives properties of this straight-forward generalization of the quantum mechanical transition probability and gives, in some important cases, an explicit expression of this quantity. (auth)

11096 (ORO-4856-37) GAUGE TRANSFORMATIONS AND QUANTUM MECHANICS (I): GAUGE INVARIANT INTERPRETATION OF QUANTUM MECHANICS. Yang, K. H. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Oct 1975. 39p. Dep. NTIS $4.00.

Quantum mechanical operators are interpreted according to their equations of motion. A gauge invariant interpretation of quantum mechanics is obtained by expanding the wave function (in an arbitrary gauge) in the orthonormal set of eigenfunctions of the particle's energy operator (in the same gauge) and by interpreting the resulting expansion coefficients as probability amplitudes. Although the gauge invariant interpretive scheme proposed is formulated for a nonrelativistic, spinless charged particle, the extension to the Dirac equation is straightforward. (auth)

11097 TRANSPORT PHENOMENA. Sitges International School of Statistical Mechanics, June 1974. Kirczenow, G.; Marro, J. (eds.). Lecture Notes in Physics. Berlin; Springer (1974). 517p.

With figs., tabs. and refs.

Topics discussed include entropy, dynamics and scattering theory; relaxation and fluctuation; fluctuating hydrodynamics and renormalization of susceptibilities and transport coefficients; irreversibility of the transport equations; ergodic theory and statistical mechanics; correlation functions in Heisenberg magnets; Enskog hard-sphere kinetic equation and the transport phenomena of dense simple gases; Lorentz models; conductivity in a magnetic field; transport properties in gases in presence of external fields; and transport properties of dilute gases with internal structure. (auth)

11098 QUARKS POSSIBLY ARE NEGATIVE MASS MAGNETIC MONOPOLES. Winterberg, F. (Nevada Univ., Reno (USA). Desert Research Inst.). Atomkernenergie; 26: No. 1, 43-47(1975).

20 refs.

Nonlinear gravitational effects require magnetic monopoles to have negative mass. We therefore propose the hypothesis that quarks are magnetic monopoles of negative mass. The positive mass of hadrons is explained as a result of the positive binding energy from the interaction of negative mass quarks. The production of free quarks would be accompanied by the delivery of a very large amount of energy in excess of the hadronic rest mass energy. Consistently with the smallness of the CP violation the interaction is assumed to be a Heisenberg-type magnetic charge exchange force. The negative mass hypothesis may explain the difficulty to produce free quarks. Free quarks could be produced in very strong magnetic fields of the order approximately 10^{17} Gauss which may occur in the focus of short wave X-ray laser beams and in the gravitational collapse of massive astronomical objects, explaining the large energy output believed to be associated with quasars. By doping solid material with negative mass quarks one could obtain superstrong materials, and macroscopic bodies approaching arbitrarily close a state of zero rest mass. The most profound consequence of such a state of matter would be in the attainability of relativistic velocities for macroscopic bodies. (auth)

11099 RELATIVISTIC STRING. Dragon, N. (Karlsruhe Univ. (TH) (F. R. Germany)). pp 331-351 of Trends in Elementary Particle Theory. Rollnik, H.; Dietz, K. (eds.) (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Berlin; Springer (1975).

6 refs.

The relativistic string is considered as a theoretical problem of its own. Stress is laid on the geometrical point of view as well as on a detailed treatment of the classical Hamiltonian formalism. Formal problems associated with incorporation of the constraints of the theory, and the unphysical features encountered in attempting a canonical quantization are discussed. (GE)

11100 PARTON MODELS FOR WEAK AND ELECTROMAGNETIC INTERACTIONS. Gourdin, M. (Paris-6 Univ., 75 (France). Lab. de Physique Theorique et Hautes Energies). pp 269-330 of Trends in Elementary Particle Theory. Rollnik, H.; Dietz, K. (eds.) (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Berlin; Springer (1975).

23 figs.; 3 tabs.; 36 refs.

The aim of these lectures is to give a review of the situation concerning inclusive reactions induced by charged and neutral leptons in the light of the quark parton model. Part A is devoted to theoretical generalities. Part B is a study of three inclusive processes: electroproduction, neutrino and antineutrino induced reactions with charge changing and charge conserving current. Part C is more speculative: polarization and weak effects in electroproduction. (GE)

11101 CRITICAL PHENOMENA AND THE RENORMALIZATION GROUP. Wegner, F. J. (Heidelberg Univ. (F. R. Germany). Inst. fuer Theoretische Physik). pp 171-196 of Trends in Elementary Particle Theory. Rollnik, H.; Dietz, K. (eds.) (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Berlin; Springer (1975).

2 figs.; 2 tabs.; 35 refs.

The recent theory of critical phenomena and the renormalization group as promoted by Wilson is considered on an introductory level. The main emphasis is on the idea of the fixed point Hamiltonian (asymptotic invariance of the critical Hamiltonian under change of the length scale) and the resulting homogeneity laws. (auth)

11102 SOLUTION OF THE PAULI-EQUATION FOR NEUTRONS IN VARYING MAGNETIC FIELDS AND ITS APPLICATION TO REFLECTION AND TRANSMISSION AT HELICAL MAGNETIC STRUCTURES. Schwink, C.; Schaerpf, O. (Technische Univ. Braunschweig (F. R. Germany). Inst. A fuer Physik). Z. Phys., B; 21: No. 3, 305-311(Jul 1975).

5 figs.; 5 refs.

The behaviour of neutrons in magnetic fields varying harmonically in time or space is treated. For the case of time-dependent fields the movement of the spins is followed in detail. For the case of helical fields the general solution of the Pauli-equation is given. It is shown that for neutrons a helical B-field is representing a medium with quite general properties of double-refraction. The formal connection between the solutions for both cases of the field is discussed. The results are applied to the reflection and transmission of neutrons at helical structures. It is shown that a critical angle exists corresponding to the angle to total reflection, but being greater than this and increasing with increasing helicity. A further main consequence of the helix field is that always a part of the reflected wave has flipped spins, its intensity depending on the polarization of the incident wave. (auth)

11103 EIGENFUNCTION EXPANSIONS FOR SCHROÈDINGER AND DIRAC OPERATORS WITH SINGULAR POTENTIALS. Nenciu, G. (Institutul de Fizica Atomica, Bucharest (Romania)). Commun. Math. Phys.; 42: No. 3, 221-229(Jun 1975).

23 refs.

The spectral theory (eigenfunction expansion theorem) is developed for Schroedinger and Dirac operators with classes of potentials including $g \exp(-\mu x)/x^2$ in the Schroedinger case and $g \exp(-\mu x)/x$ in the Dirac case. (auth)

11104 BOUND-STATE ENERGIES OF THE EXPONENTIALLY SCREENED STATIC AND COSINE COULOMBIC POTENTIALS. Bessis, N.; Bessis, G.; Corbel, G.; Dakhel, B. (Laboratoire de Spectroscopie et de Luminescence, Université Claude Bernard, Lyon I, 43, bd du 11 novembre 1918, 69621 Villeurbanne, France). J. Chem. Phys. 63: No. 9, 3744-3749 (1 Nov 1975).

Bound state energies of the exponentially screened Coulomb potentials: $V(r) = -Ze^{-\alpha r}\cos\epsilon\alpha r/r$, static ($\epsilon=0$) and oscillatory ($\epsilon=1$), are obtained by a perturbation calculation on the basis of the Hulthén functions. Closed form expressions of the perturbative matrix elements as well as of the Hulthén functions, for "S" states and for $l\neq0$ states (with an approximated rotational term), are obtained by the ladder operator method. When varying the values of the Hulthén parameter, the first order perturbed eigenvalues of the screened potentials are found to be close to the exact values. New results ($l\neq0$) are given for the cosine case. (auth)

11105 NONEQUILIBRIUM STATIONARY COUPLING OF SOLITONS. Nakajima, K.; Sawada, Y.; Onodera, Y. (Research Institute of Electrical Communication, Tohoku University, Sendai, Japan). J. Appl. Phys. 46: No. 12, 5272-5279 (Dec 1975).

By computer simulation, interaction of two solitons with the same screw sense of the sine-Gordon equation, which retain their shapes and velocities upon collision with other solitons even in the presence of bias and loss terms, are examined. It is confirmed that they can couple when the bias is greater than a critical value. The conditions and mechanism of coupling are examined in detail. They are explained in terms of the energy of interaction between the ripple structures trailed by energy dissipative moving solitons. The distance D between coupled solitons can be expressed as $D = (n-1/2-\delta)\lambda$ (n is an integer), where λ is a wavelength of the ripple structure and $\delta<1$. (auth)

11106 ALGEBRA OF LEVEL SPLITTING AND A POSSIBLE GENERALIZATION. Basano, L.; Cenni, R. (Univ., Genoa). Lett. Nuovo Cim.; 14: No. 1, 36-40(6 Sep 1975).

A convincing illustrative example of the simplicity of the method of the algebra of level splitting is provided, and a generalization is attempted that may be worth further investigation. (JFP)

11107 SOME EXPERIMENTS LEADING TO A REVISION OF THE FOUNDATIONS OF QUANTUM MECHANICS. Datzeff, A. B. (Univ., Sofia). Nuovo Cim.; 29B: No. 1, 105-123(11 Sep 1975).

When a homogeneous electron beam passes through a hole in a screen, according to quantum mechanics a well known diffraction picture is obtained. It does not depend on the density ρ of the electrons, because Schroedinger's equation is linear. But the experiment contradicts this deduction, because actually the cross section of the beam dilatates behind the screen for large ρ. According to the new viewpoint on quantum mechanics proposed, a generalized nonlinear Schrödinger equation is obtained. From this it follows both a dilatation of the electron beam and a change in de Broglie's wavelength, depending on ρ. The attempt to check these effects may turn into a crucial experiment. (auth)

11108 EXPERIMENTAL IMPLICATIONS OF THE REINTERPRETATION OF QUANTUM MECHANICS. Werbos, P. J. (Univ. of Maryland, College Park). Nuovo Cim.; 29B: No. 1, 169-177 (11 Sep 1975).

Recent concepts from the philosophy of science suggest that the Everett-Wheeler interpretation of quantum mechanics has a higher probability of truth than the classical Heisenberg interpretation. As a realistic theory, the Everett-Wheeler approach has a number of utilitarian advantages, including its ability to serve as a steppingstone to related, even less phenomenological, theories, which have significant and testable differences from quantum mechanics. One such theory—the "soap bubble" model of the universe—appears to fit the present experimental data better than quantum mechanics does, though further experiments are clearly required. (auth)

11109 DEFINITION OF A CLASS OF TRANSFORMATIONS LEADING TO EQUIVALENT HAMILTONIAN REPRESENTATIONS OF THE DIRAC EQUATION. Roux, J. F.; Phan Vaa Loc. (Faculte des Sciences, Parc de Grandmont, France). Nuovo Cim.; 29B: No. 1, 225-238(11 Sep 1975).

A class of unitary transformations is deduced from an equation connecting the Hamiltonian H of a Dirac particle, its transformed expression H' and a Hermitian operator Λ, provided a condition between H and H' holds. These transformations permit bringing H' in either an even or odd form, in the sense of Foldy and Wouthuysen. (auth)

11110 ANALYTIC AND GRAPHICAL METHODS FOR ASSIGNING ERRORS TO PARAMETERS IN NON-LINEAR LEAST SQUARES FITTING. Rogers, D. W. O. (National Research Council of Canada, Ottawa, Ontario. Div. of Physics). Nucl. Instrum. Methods; 127: No. 2, 253-260(1 Aug 1975).

Using a single notation, a summary is presented of the various analytic and graphical methods used for assigning errors to individual parameters determined in linear and non-linear least square fitting procedures, with emphasis on cases with few degrees of freedom (e.g., the multipole mixing ratio problem in gamma ray spectroscopy). The ranges of applicability of each method and the relationships between the methods are discussed with particular emphasis placed on distinguishing between the cases for which the magnitudes of variances on the input data are known and those for which they are not known. It is shown directly that the graphical $\chi^2_{min} + 1$ rule is equivalent to the analytic internal error estimates and the corresponding graphical limit for the external error estimates is given by $\chi^2_{min}[1 + (1/n\text{-}p) F_\alpha(1,n\text{-}p)]$. An explicit formula is given for transforming from one error estimate to another. A direct analytic procedure is presented for determining the diagonal elements of the error matrix without calculating or inverting the normal matrix. Tables of the statistical F and t distributions at the 68.3% and 95.5% confidence levels are also given. A simulation of a simple fitting experiment is discussed to clarify the concepts involved. (NL)

11111 COHERENT STATES AND ASYMPTOTIC BEHAVIOR OF THE SYMMETRIC TOP WAVE FUNCTIONS. Doktorov, E. V.; Malkin, I. A.; Man'ko, V. I. (Lebedev Inst. of Physics, Moscow). Int. J. Quant. Chem.; 9: No. 6, 951-968(Nov 1975).

Wave packets which may be considered as an analog of the coherent states of the top are constructed. New integral representations are obtained for the D-function; making use of those, various types of the asymptotic behavior of the D-function are obtained in the region of large quantum numbers. (auth)

11112 OPERATOR FORMALISM FOR FORMING KET VECTORS UNDER SOME CONSTRAINTS. Morikawa, T. (Tokyo-Kyoiku Univ., Otsuka, Japan). Int. J. Quant. Chem.; 9: No. 6, 969-973(Nov 1975).

Reformulation, generalization, and application of Loewdin's symmetric orthonormalization, of orthogonalization of two sets of vectors, and of McWeeny's variational method of a density matrix, etc., by means of an operator for forming ket vectors on which are imposed some conditions, are presented. (auth)

11113 DUAL TREES AND RESUMMATION THEOREMS. Friedberg, R. (Columbia Univ., New York). J. Math. Phys. (N. Y.); 16: No. 1, 20-30(Jan 1975).

Various resummation theorems known for graphical expansions in statistical physics and field theory are exhibited as special cases of a single symmetrical, easily remembered theorem on a generalized structure named a dual tree. (5 figures) (auth)

11114 DISCRETE STATE PERTURBATION THEORY VIA GREEN'S FUNCTIONS. Rubinson, W. (Brookhaven National Lab., Upton, NY). J. Math. Phys. (N. Y.); 16: No. 1, 50-53(Jan 1975).

The exposition of stationary-state perturbation theory via the Green's function method in Goldberger and Watson's Collision Theory is reworked in a way that makes explicit its mathematical basis. It is stressed that the theory consists of the construction of, and manipulations on, a mathematical identity. The perturbation series fall out of the identity almost immediately. The logical status of the method is commented on. (auth)

Quantum Field Theories

Refer also to abstracts 10070, 10422, 10433, 10462, 11113, and 11189.

11115 (COO-3069-339) QUANTUM MECHANICAL APPROXIMATIONS IN QUANTUM FIELD THEORY. Jackiw, R. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Nuclear Science; Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics). 1975. Contract AT(11-1)-3069. 47p. (CONF-750110-9; CONF-750125-2) Dep. NTIS $5.00.

From Orbis scientist meeting; Coral Gables, Florida, USA (21 Jan 1975).

Some cooperative, coherent effects in quantum field theory, such as spontaneous symmetry violation, bound states, and entrapment of various excitations, can be exposed only by approximation procedures which do not rely on analyticity or regularity in the coupling constant. These procedures are extended to relativistic quantum field theory. The following procedures are considered: Rayleigh–Ritz variation, self-consistent (Hartree–Fock) approach, semiclassical approximation, and the Kerman–Klein method (including generalized Tamm–Dancoff calculations; Hartree, Hartree–Fock, and Hartree–Fock–Bogolyubov techniques; and random phase approximation). The problems of symmetry behavior at zero and finite temperature, coherent bound states in field theory, and dynamical symmetry breaking are discussed. 4 figures. (RWR)

11116 (LNF-75/37(R)) TOWARD A FIELD THEORY OF CONFINEMENT. Parisi, G. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati). 15 Jul 1975. 6p. Dep. NTIS (US Sales Only) $4.50.

The use of compact techniques is proposed to obtain exact and approximate results in field theories in which a nonlocal long range interaction is present. (auth)

11117 RENORMALIZATION OF THE ABELIAN HIGGS–KIBBLE MODEL. Becchi, C.; Rouet, A.; Stora, R. (Centre National de la Recherche Scientifique, 13–Marseille (France). Centre de Physique Theorique). Commun. Math. Phys.; 42: No. 2, 127-162(May 1975).

3 tabs.; 15 refs.

This article is devoted to the perturbative renormalization of the abelian Higgs–Kibble model, within the class of renormalizable gauges which are odd under charge conjugation. The Bogoliubov Parasiuk Hepp–Zimmermann renormalization scheme is used throughout, including the renormalized action principle proved by Lowenstein and Lam. The whole study is based on the fulfilment to all orders of perturbation theory of the Slavnov identities which express the invariance of the Lagrangian under a supergauge type family of non-linear transformations involving the Faddeev-Popov ghosts. Direct combinatorial proofs are given of the gauge independence and unitarity of the physical S operator. Some simple gauge independent local operators are constructed. (GE)

11118 QUARK CONFINEMENT IN GAUGE THEORIES OF STRONG INTERACTIONS. Susskind, L. (Yeshiva Univ., New York (USA). Belfer Graduate School of Science; Tel Aviv Univ. (Israel)). pp 234-268 of Trends in Elementary Particle Theory. Rollnik, H.; Dietz, K. (eds.) (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Berlin; Springer (1975).

23 figs.; 11 refs.

Three examples of theories with confinement are discussed: Schwinger's one dimensional QED; asemiclassical model based on unusual dielectric properties of the vacuum; and a Hamiltonian formulation of Wilson's lattice gauge theory. (GE)

11119 QUANTUM GRAVITY. t'Hooft, G. (Rijksuniversiteit Utrecht (Netherlands)). pp 92-113 of Trends in Elementary Particle Theory. Rollnik, H.; Dietz, K. (eds.) (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Berlin; Springer (1975).

1 fig.; 14 refs.

After a brief summary of the conventional theory of general relativity, seen from the viewpoint of a gauge field theorist, it is indicated how quantization could be carried out in principle. In practice we need a more sophisticated formalism, this formalism — the background field method — is explained and discussed in connection with gauge theories. It is shown why only pure gravity is finite up to the one-loop corrections. (GE)

11120 QUANTUM FIELD THEORY AND STATISTICAL MECHANICS. Jegerlehner, F. (Freie Univ. Berlin (F. R. Germany)). pp 114-170 of Trends in Elementary Particle Theory. Rollnik, H.; Dietz, K. (eds.) (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Berlin; Springer (1975).

5 figs.; 1 tab.; 33 refs.

At first a heuristic understanding is given how the relation between quantum field theory and statistical mechanics near phase transitions comes about. A long range scale invariant theory is constructed, critical indices are calculated and the relations among them are proved, field theoretical Kadanoff-scale transformations are formulated and scaling corrections calculated. A precise meaning to many of Kadanoffs considerations and a model matching Wegners phenomenological scheme is given. It is shown, that soft parametrization is most transparent for the discussion of scaling behaviour. (GE)

11121 COLLISION THEORY FOR MASSLESS FERMIONS. Buchholz, D. (European Organization for Nuclear Research, Geneva (Switzerland)). Commun. Math. Phys.; 42: No. 3, 269-279(Jun 1975).

9 refs.

Starting from the basic postulates of local relativistic quantum theory, the asymptotic incoming and outgoing collision states of massless Fermions are constructed. The corresponding Hilbert spaces have Fock structure and thus allow the usual definition of an S-matrix. In contrast to the massive case, there are geometric relations between the local nets of the underlying field algebra and the asymptotic fields. (auth)

11122 RENORMALIZATION OF GAUGE THEORIES. Zinn-Justin, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France)). pp 2-39 of Trends in Elementary Particle Theory. Rollnik, H.; Dietz, K. (eds.) (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Berlin; Springer (1975).

With refs.

The change of variables in the functional integration and the renormalization of global and local symmetries are considered. A simple derivation of the Ward-Takahashi identities in the case of linear gauges is given and generalized to quadratic gauges. (GE)

11123 OSTERWALDER–SCHRADER POSITIVITY IN CONFORMAL INVARIANT QUANTUM FIELD THEORY. Mack, G. (Bern Univ. (Switzerland). Inst. fuer Theoretische Physik; Institute for Advanced Study, Princeton, N. J. (USA)). pp 66-91 of Trends in Elementary Particle Theory. Rollnik, H.; Dietz, K. (eds.) (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Berlin; Springer (1975).

2 figs.; 17 refs.

In the present notes we will describe an attempt to gain some insight into the nature of the axiomatic positivity constraint in local quantum field theory. We will restrict our attention to exactly conformal invariant quantum field theories. Such theories will describe the short distance behavior of more realistic theories, and they are interesting as a laboratory, because they can be analyzed to a remarkable extent by nonperturbative technique. (GE)

11124 ALGEBRA OF FIELD OPERATORS: THE WEAK COMMUTANT AND INTEGRAL DECOMPOSITIONS OF STATES. Borchers, H. J.; Yngvason, J. (Goettingen Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Commun. Math. Phys.; 42: No. 3, 231-252(Jun 1975).

18 refs.

It is shown that every continuous representation of a nuclear and separable *-algebra on a separable Hilbert space has a certain integral decomposition into representations with a trivial weak commutant. This result is used to obtain a decomposition of Wightman functionals into extremal states. An example is given of an extremal Wightman functional which does not have the cluster property. (auth)

11125 BILOCAL FIELD THEORY OF ELEMENTARY PARTICLES. Vollendorf, F. Z. Naturforsch., a; 30: No. 6/7, 891-895(Jun 1975). (In German).

7 refs.

The basic idea of this article is that in a bilocal field theory the Lorentz group can be replaced by the larger group SO(4;4) which contains SO(3;1) as a subgroup. On this basis a system of 24 coupled differential equations is introduced. In the special case of the pion the connection with the local field theory is discussed. It turns out that the application of the local field theory is limited by the reduced Compton wave length lambda/2π of the pion. (auth)

11126 LOCAL FIELD PRODUCTS IN SPECIAL WIGHTMAN THEORIES. Baumann, K. (Bell Labs., Murray Hill, N. J. (USA); Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (F. R. Germany)). Commun. Math. Phys.; 43: No. 1, 73-87(1975).

11 refs. Based in part on the author's thesis.

We shall try to define local field products under assumptions imposed only on the four-point-function. This idea is based on the work of Schlieder and Seiler. In our framework we shall prove that the two-point-function carries the strongest singularity whenever two arguments in a Wightman function coincide. This will be generalized to the case when more arguments coincide. We shall define "regulated" n-point-functions and study their properties in detail. This will lead us to the definition of arbitrarily high powers of the field-operators as operator-valued distributions over $D(R^4)$ in the center coordinate with a dense domain of definition. (auth)

11127 CONNEXION OF DUALITY AND CAUSAL PROPERTIES FOR GENERALIZED FREE FIELDS. Garber, W. D. (Goettingen Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Commun. Math. Phys.; 42: No. 3, 195-208(Jun 1975).

2 figs.; 29 refs.

It is shown that the time-slice axiom and the diamond property are equivalent for the generalized free field. If, in addition, there is a mass gap, duality is equivalent to either causality requirement. It is further shown that the local rings associated with certain spacetime regions are factors in the case of causal generalized free fields with mass gap. Necessary and sufficient conditions for causality and duality and some examples for causal and acausal generalized free fields are also given. (auth)

11128 EUCLIDEAN FIELD THEORY. I. The Moment Problem. Challifour, J. L.; Slinker, S. P. (Indiana Univ., Bloomington (USA). Dept. of Physics). Commun. Math. Phys.; 43: No. 1, 41-58(1975).

21 refs.

The extension of the Schwinger functions to various positive linear functionals on the Borchers algebra is discussed. In one case, we construct a measure on S' and give criteria for uniqueness as well as for the homogeneous chaos to lead to an L_2-space. (auth)

11129 SMALL-DISTANCE BEHAVIOR IN FIELD THEORY. Symanzik, K. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). pp 20-72 of Particles, Quantum Fields, and Statistical Mechanics. Alexanian, M.; Zepda, A. (eds.) (Instituto Politecnico Nacional, Mexico City. Centro de Investigacion y de Estudios Avanzados). Berlin, F. R. Germany; Springer (1975).

1 fig.; 70 refs.

These lectures give a review of techniques for large-momenta-behaviour analysis in renormalizable field theories, and of results thereby obtained. For the sake of brevity of formulae, the PHI^4 theory will be used to explain the ideas involved. Only in the last two sections more general theories will be discussed and specific results for some particular theories mentioned. (auth)

11130 QUARK TRAPPING IN A MODEL FIELD THEORY. Frishman, Y. (Weizmann Inst. of Science, Rehovoth (Israel)). pp 118-132 of Particles, Quantum Fields, and Statistical Mechanics. Alexanian, M.; Zepeda, A. (eds.) (Instituto Politecnico Nacional, Mexico City. Centro de Investigacion y de Estudios Avanzados). Berlin, F. R. Germany; Springer (1975).

10 figs.; 9 refs.

The interaction of an electromagnetic potential with a massless fermion field is studied in one dimension momentum space. The photon propagator is given exactly by the geometric series of the second order bubble. There are no scattering amplitudes involving on-shell fermion lines and no on-shell fermi-fermi scattering. Annihilation of pairwise quarks into mesons does not contribute in this model. (GE)

11131 SCHWINGER FUNCTIONS FOR THE YUKAWA MODEL IN TWO DIMENSIONS WITH SPACE-TIME CUTOFF. Seiler, E. (Institute for Advanced Study, Princeton, N. J. (USA)). Commun. Math. Phys.; 42: No. 2, 163-182(May 1975).

5 figs.; 24 refs.

It is shown that a Euclidean version of the formulae of Matthews and Salam for the Green's functions of a two-dimensional Yukawa model with interaction in a finite space-time volume makes sense, if renormalized correctly. (auth)

11132 SCALAR PRODUCTS OF SPINOR FIELD FUNCTIONALS AND STATE REPRESENTATIONS IN NONLINEAR SPINOR FIELD QUANTUM THEORY. Stumpf, H. (Tuebingen Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Z. Naturforsch., 30A; No. 6/7, 708-720(Jun 1975).

18 refs.

In preceding papers it was shown that in nonlinear spinor theory cross-sections of elementary particle scattering processes can be calculated only if the state representations and their scalar products are explicitly known. To obtain these quantities, functional quantum theory of the nonlinear spinor field was introduced. In this paper it is demonstrated that the introduction of functional scalar products in functional quantum theory is adequate to impose restrictions to the spinor field operator itself concerning its groundstate behaviour. Performing this, explicit state representations of spinor field states as well as corresponding scalar products can be derived, leading thus to functional quantum theories of the spinor field in dependence on the groundstate model. It follows from these considerations that a spinor field quantum theory is in principle incomplete, as long as no additional assumptions on the groundstate are made, which cannot be derived from the general dynamics of the field. (auth)

11133 UEBUNGSAUFGABEN ZUR QUANTENTHEORIE. Quantentheoretische Grundlagen. (Exercises on the Quantum Theory. Fundamentals of the Quantum Theory). Grau, D. (Technische Hochschule, Vienna (Austria). Inst. fuer Theoretische Physik). Buchereihe der Atomkernenergie. Muenchen, F. R. Germany; Thiemig (1975). 387p.

With figs. and tabs.; 18 refs.

The book is divided in two main parts: the unitarian vector space and the quantum theory. Elementary exercises with solutions are given on both. Stationary states, parity, types of presentation, motion equations, perturbation theory, angular momentum, scattering and application to single atoms are dealt with. (GE)

11134 AXIOMS FOR EUCLIDEAN GREEN'S FUNCTIONS. II. Osterwalder, K. (Harvard Univ., Cambridge, Mass. (USA). Jefferson Lab. of Physics); Schrader, R. (Freie Univ. Berlin (F. R. Germany). Inst. fuer Theoretische Physik). Commun. Math. Phys.; 42: No. 3, 281-305(Jun 1975).

1 fig.; 21 refs.

We give new (necessary and) sufficient conditions for Euclidean Green's functions to have analytic continuations to a relativistic field theory. These results extend and correct a previous paper. (auth)

11135 GLOBAL CONFORMAL INVARIANCE IN QUANTUM FIELD THEORY. Luescher, M.; Mack, G. (Bern Univ. (Switzerland). Inst. fuer Theoretische Physik). Commun. Math. Phys.; 41: No. 3, 203-234(Apr 1975).

3 figs.; 33 refs.

Suppose that there is given a Wightman quantum field theory (QFT) whose Euclidean Green functions are invariant under the Euclidean conformal group G approximately = SO(5,1). We show that its Hilbert space of physical states carries then a unitary representation of the universal (infinitely-sheeted) covering group G^* of the Minkowskian conformal group $SO(4,2)Z_2$. The Wightman functions can be analytically continued to a domain of holomorphy which has as a real boundary an infinitely-sheeted covering M tilde of Minkowski-space M^4. It is known that G^* can act on this space M tilde and that M tilde admits a globally G^*-invariant causal ordering; M is thus the natural space on which a globally G^*-invariant local QFT could live. We discuss some of the properties of such a theory, in particular the spectrum of the conformal Hamiltonian $H = 1/2(P^0 + K^0)$. (GE)

11136 HIGHER ORDER ESTIMATES FOR THE YUKAWA (2) QUANTUM FIELD THEORY. McBryan, O. A. (Toronto Univ., Ontario (Canada). Dept. of Mathematics). Commun. Math. Phys.; 42: No. 1, 1-7(May 1975).

6 refs.

Higher order estimates are proved for the Yukawa(2) models with and without SU-3 symmetry. We also prove norm convergence. (GE)

11137 DIRECTIONAL DEPENDENCE OF COMPOSITE FIELD OPERATORS. Adetunji, O. (Univ. of Manitoba, Winnipeg). Nuovo Cim., A; 29A: No. 2, 174-186(21 Sep 1975).

For cases in which the singularities of the matrix elements occurring in the Wilson-Zimmermann expansion of the product of n local fields are concentrated at $\xi^2 = 0$, two theorems proved by Otterson and Zimmermann for the $n = 2$ case are shown to hold for general n and for the special combinations $A_1(x_1)A_2(x_2) \ldots A_n(x_n)$ and $A_n(x_n) \ldots A_2(x_2)A_1(x_1)$ of the operators. (auth)

11138 GROUP PROPERTIES OF RENORMALIZED GAUGE TRANSFORMATIONS. Julve, J.; Tonin, M. (Univ., Padua). Nuovo Cim., A; 29A: No. 1, 85-105(1 Sep 1975).

In a gauge theory the gauge group structure constants and field transformations are modified during the renormalization procedure. It is proven for any compact gauge group that the renormalized and unrenormalized groups are isomorphic and that the re-

normalized and unrenormalized fields representations are equivalent. An explicit expression for the renormalization constants is obtained. (auth)

11139 RENORMALIZATION GROUP REPRESENTATIONS AND THE CALLAN–SYMANZIK EQUATION. Tirapegui, E. (International Centre for Theoretical Physics, Trieste, Italy). Nuovo Cim., A; 29A: No. 2, 153-173(21 Sep 1975).

One obtains the implications on the renormalization group representations of a renormalizable theory of the fact that the functions $\beta(g)$ and $\gamma(g)$ of the Callan-Symanzik equation are finite at every order of perturbation theory. Also one studies asymptotic behavior and concludes that it is impossible to decide from perturbation theory data if the behavior for large momenta is independent or not of the coupling constant g. One explicitly exhibits, adopting an example of Jouvet, a mechanism leading to a g-dependent behavior and which is consistent with all perturbation theory constraints. The situation is characterized by the global function $\beta(g) \equiv 0$ although its perturbation series is different from zero. (auth)

11140 EXACT SOLUTIONS OF THE SPINOR BETHE–SALPETER EQUATION FOR TIGHTLY BOUND STATES. Suttorp, L. G. (Univ., Amsterdam). Nuovo Cim., A; 29A: No. 2, 225-255(21 Sep 1975).

Exact solutions are obtained for the spinor Bethe-Salpeter equation that describes tightly bound states of spin-½ fermions with massless-boson exchange. The corresponding coupling constants form a discrete spectrum that depends continuously on the parameters characterizing the type of fermion-boson interaction. (auth)

11141 FUNCTIONAL INTEGRATION IN THE THEORY OF AN ELECTROMAGNETICALLY INTERACTING RELATIVISTIC MATERIAL POINT: AN EXACT RESULT. Barducci, A. (Univ., Firenze, Italy); Giachetti, R. Nuovo Cim., A; 29A: No. 2, 256-266 (21 Sep 1975).

The quantum-mechanical interaction of a relativistic material point with an external radiation field is studied by the path-integral method. A transformation is found which allows the evaluation of the Feynman amplitude in a closed form, and an exact expression is given for the propagation in the proper-time representation. (auth)

11142 FIELD OPERATOR PRODUCTS AT SHORT DISTANCES AND THE LOOP EXPANSION. Bui-Duy, Q. Ark. Fys. Semin. Trondheim; No. 9, 8(1975).

Recent experimental results on deep inelastic electron-nucleon scattering and e^+e^- total annihilation into hadrons have led to increased interest in the properties of products of electromagnetic currents separated by short distances. Instead of dealing directly with the electromagnetic structure of hadrons, it seems to be sufficient to investigate the light-cone expansion in different field models with a view to abstract general features. A nonperturbative calculation of scalar field operator products at short distances is presented. The π^4 theory is examined and the extension to the π^3 theory is also given. (JIW)

11143 HIGH ENERGY QUANTUM ELECTRODYNAMICS: A FUNCTIONAL APPROACH. Bui-Duy, Q. Ark. Fys. Semin. Trondheim; No. 8, 13(1975).

It is shown that, under certain conditions, dynamical effects of a highly energetic electron are equivalent to those of a static and transversal potential. This equivalence leads naturally to the use of Cheng and Wu's impact diagrams for high energy collisions. The Compton scattering is discussed. (auth)

11144 CANONICAL AND LORENTZ-COVARIANT QUANTIZATION OF YANG–MILLS THEORIES. Curci, G. (Univ., Pisa, Italy); Ferrari, R. Nuovo Cim.; 30A: No. 1, 155-168(1 Nov 1975).

A Lorentz-covariant quantization of non-Abelian gauge theories is performed by using the canonical formalism. The Faddeev-Popov ghost is shown to be a consequence of two requirements: the vector states describing physical and longitudinal vector mesons should be orthogonal and there should be no transition between physical and unphysical modes. The Slavnov-Taylor identities are derived. The metric of the vector space is studied. (auth)

11145 NEW RENORMALIZATION GROUP EQUATIONS IN A SPONTANEOUSLY BROKEN GAUGE THEORY. Fleming, H.; Frenkel, J. (Univ. of Sao Paulo, Brazil). Nuovo Cim., A; 30A: No. 1, 93-110(1 Nov 1975).

A study of the new renormalization group equations is made using the dimensional regularization scheme. It is shown, in a model-independent way, that these equations can be derived simply by writing the dimensional analysis for the regularized Green's functions and next re-expressing the result in terms of renormalized parameters and fields. The solution, valid for arbitrary momenta, involves effective momentum-dependent masses and coupling constants. For spontaneously broken gauge theories the solution involves effective momentum-dependent vacuum expectation values and gauge parameters. These features are exemplified in the context of a spontaneously broken Abelian model where the roles of these effective momentum-dependent parameters are explicitly discussed. (auth)

11146 SHEAR FREE SOLUTIONS OF MAXWELL'S EQUATIONS. Ludvigsen, M. (Univ. of Botswana Lesotho and Swaziland, Gaborone). Gen. Relativ. Gravitation; 6: No. 2, 165-174 (Apr 1975).

A twisting shear free solution of Maxwell's equations is obtained by transforming to a complex coordinate system in which the corresponding solution is complex but twist free. The equations in this system are easily solved, and, by transforming back to the original coordinates, a twisting shear free solution of Maxwell's equations is obtained. (auth)

11147 REPRESENTATIONS OF A LOCAL CURRENT ALGEBRA: THEIR DYNAMICAL DETERMINATION. Menikoff, R.; Sharp, D.H. (Theoretical Division, Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). J. Math. Phys. (N.Y.) 16: No. 12, 2341-2352 (Dec 1975).

Local currents are used to describe nonrelativistic many-body quantum mechanics in the thermodynamic limit. The problem of determining a representation of the local currents corresponding to a given Hamiltonian is studied. We formulate the dynamics in such a way that one solves simultaneously for the ground state and the representation of the local currents. This leads to two coupled functional equations relating the generating functional to a functional which describes the ground state. Together these functionals determine a representation of the local currents in which the Hamiltonian is a well-defined operator. The functional equations are equivalent to a set of integro-differential equations for expansion coefficients of the two functionals. (auth)

11148 APPROXIMATE REPRESENTATIONS OF A LOCAL CURRENT ALGEBRA. Menikoff, R.; Sharp, D.H. (Theoretical Division, Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). J. Math. Phys. (N.Y.) 16: No. 12, 2353-2360 (Dec 1975).

An approximate method for dealing with nonrelativistic many-body quantum systems having short range interactions is developed using local currents. The scheme is based on determining approximate representations of subalgebras of the local currents. This mathematical framework is used to discuss several approximation schemes. (auth)

11149 SPECTRAL REPRESENTATION OF THE CONFORMAL COVARIANT TWO-POINT FUNCTION FOR FIELDS WITH ARBITRARY SPIN. Zaikov, R. P. (Higher Pedagogical Inst., Shumen, Bulgaria). Bulg. J. Phys.; 2: No. 2, 89-97(1975).

A spectral representation of the conformal covariant two-point function for fields with arbitrary spin is given. From the conformal invariance it follows that the fields for which the two-point function is different from zero can have one and the same dimensionality and be transformed according to mutually conjugated representations of SL (2, C). In the case of finite-component fields with canonical dimensionality, the maximal spin alone is included in the decomposition. All kinds of spins, however, are included in it for all the other dimensionalities, and in the case of dimensionalities higher than the canonical the two-point function is positively defined and local. (auth)

11150 FIELD OPERATOR PRODUCTS AT SHORT DISTANCES AND THE LOOP EXPANSION. Bui-Duy, Q. (Univ. of Trondheim, Norway). Lett. Nuovo Cim.; 14: No. 1, 19-23(6 Sep 1975).

A nonperturbative calculation of scalar field operator products at short distances is reported. The ϕ^4 theory is examined. The extension to ϕ^3 theory is also given. (JFP)

11151 HIGH ENERGY QUANTUM ELECTRODYNAMICS: A FUNCTIONAL APPROACH. Bui-Duy, Q. (Univ. of Trondheim, Norway). Lett. Nuovo Cim.; 14: No. 1, 24-30(6 Sep 1975).

It is shown that when self-radiative corrections to the electron are neglected, and when the external potential does not come from real photons involved in the process, dynamical effects of the fast electron are equivalent to those of a static and transversal potential. This result comes from the fact that the transition matrix of a highly energetic electron is exponentially linear in the external potential. The dynamics of a physical system which involves a very fast electron remains unchanged if one removes the electron, but, at the same time, puts the system in a determined potential. Generalizations to systems of two fast electrons can also be derived similarly. (JFP)

11152 SOLUTION OF EQUATIONS OF CONNECTION IN THE NEW UNIFIED FIELD THEORY. Ghosh, N. N. (Bose Inst. of Physical Sciences, Calcutta). Indian J. Phys.; 49: No. 5, 401-402(May 1975).

Modified formulas are applied to the case of a special non-symmetric tensor field with symmetric and antisymmetric components, where all components are functions of four variables. (JFP)

11153 FIELD QUANTIZATION ON SPACETIME HYPERBOLOIDS. Prasad, M. K. New Haven; Yale Univ. (1975). 77p. University Microfilms Order No. 75-24,591.

Thesis (Ph. D.).

A manifestly Lorentz invariant quantization scheme which specifies commutation relations on spacelike hyperboloids is studied for spin 0, ½, and 1 fields. The translational covariance of the theory becomes a dynamical problem. The fundamental result being an appearance of an infinity of unitarily inequivalent Fock representations. Attempt is made to study simple interactions, vertex functions, and matrix elements with an emphasis on physical interpretation. (Diss. Abstr. Int., B)

11154 FIELD THEORY ANOMALIES INVOLVING THE ENERGY-MOMENTUM TENSOR. Zacrep, D. B. Ames, IA; Iowa State Univ. (1975). 91p. University Microfilms Order No. 75-25,361.

Thesis (Ph. D.).

Generalized Ward–Takahashi identities (WTI's) of the energy-momentum tensor in a free spinor field theory with SU(3) currents were analyzed for possible noncanonical behavior (anomalies). The WTI's, derived by a functional integration technique, are the divergence equations for the axial-vector, vector, and tensor currents in n-point functions (n-pf's), i.e., Green's functions, involving the energy-momentum tensor and all possible combinations of vector, axial-vector, scalar, and pseudoscalar external currents (V, A, S, and P). In addition the trace identities (TI) of the n-pf's involving the energy–momentum tensor were investigated. (Diss. Abstr. Int., B)

11155 PATH INTEGRAL FORMULATION OF FIELD THEORIES WITH SECOND-CLASS CONSTRAINTS. Senjanovic, P. I. New York; City Univ. of New York (1975). 100p. University Microfilms Order No. 75-25,209.

Thesis (Ph. D.).

Faddeev's Hamiltonian path integral method for singular Lagrangians is generalized to the case when second-class constraints appear in the theory. The general formalism is then applied to a variety of problems: quantization of first-order field theories, quantization of the massive Yang–Mills field theory, light-cone quantization of the self-interacting scalar field theory and quantization of a local field theory of magnetic monopoles. (Diss. Abstr. Int., B)

11156 OSTERWALDER-SCHRADER AXIOMS FOR QUANTUM FIELD THEORIES OVER JAFFE SPACES. Slinker, S. P. Bloomington, IN; Indiana Univ. (1975). 92p. University Microfilms Order No. 75-23,511.

Thesis (Ph. D.).

A set of Wightman axioms for field theories over Jaffe spaces is proposed. The Wightman distributions are then analytically continued to the Euclidean region where they are called Schwinger functions. A set of axioms for the Schwinger functions is found which is equivalent to the original Wightman axioms. Thus, this is a direct parallel to the original papers of Osterwalder and Schrader for field theories over the space of tempered functions. Similar results to those contained were proven independently by Constantinescu and Thalheimer. (Diss. Abstr. Int., B)

11157 MATRIX FORMULATION OF SPECIAL RELATIVITY IN CLASSICAL MECHANICS AND ELECTROMAGNETIC THEORY. Frost, A. A. (Northwestern Univ., Evanston, IL). Found. Phys.; 5: No. 4, 619-641(Dec 1975).

The two-component spinor theory of van der Waerden is put into a convenient matrix notation. The mathematical relations among various types of matrices and the rule for forming covariant expressions are developed. Relativistic equations of classical mechanics and electricity and magnetism are expressed in this notation. In this formulation the distinction between time and space coordinates in the four-dimensional space-time continuum falls out naturally from the assumption that a four-vector is represented by a Hermitian matrix. The indefinite metric of tensor analysis is a derived result rather than an arbitrary ad hoc assumption. The relation to four-component spinor theory is also discussed. (auth)

11158 PHASE CONSISTENT DEVELOPMENT OF AN ENSEMBLE OF QUANTUM SYSTEMS BY ONE-PHOTON EMISSION PROCESSES. Rose, H. J. (Oxford Univ. (UK). Nuclear Physics Lab.). Nucl. Phys., A; 248: No. 3, 496-508(1 Sep 1975).

The common starting point of the phase-consistent γ-ray angular distribution theory of Rose and Brink is generalised to cover the case of photon emission from mixed ensembles. The result may be looked upon as a phase-consistent generalisation of the well-known "golden rule" which now may be applied to physical ensembles that need not necessarily be in pure states. The result is obtained by straightforward application of time-development techniques in combination with density matrix formalism, using a quantum- electrodynamic interaction and standard first-order perturbation theory. (NL)

11159 PERTURBATION THEORY IN TERMS OF SUPERFIELDS AND ITS APPLICATION TO GAUGE THEORIES. Honerkamp, J.; Sclindwein, M. (Freiburg Univ. (F. R. Germany). Fakultaet fuer Physik); Krause, F.; Scheunert, M. (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Nucl. Phys., B; 95: No. 3, 397-426(8 Sep 1975).

A perturbation theory is formulated in terms of superfields for Lagrangian field theories, which are expressable by chiral or general scalar superfields. The generalized QED model of Wess and Zumino is especially considered where an additional local gauge symmetry is present. The calculations are manifestly covariant with respect to supersymmetry and local gauge transformation. (NL)

11160 INFINITE ORDER RADIATIVE CORRECTIONS AND RENORMALIZATION. Matsson, L. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). Nucl. Phys., B; 95: No. 3, 434-444(8 Sep 1975).

By means of Ward identity and the correlation expansion derived earlier, virtual radiative corrections are calculated to an infinite order. Partial factorization of the correlation effects, as in the simple exchange processes, makes infinite summation possible. Furthermore, because the Ward identity is satisfied order by order and because it is possible to carry out the infinite order summation and obtain a closed form, renormalization turns out to be very simple and transparent. Here the calculations are performed for a scalar: phi^2:phi model, but are easily generalized to other similar models. It is also indicated why this rearrangement of the ordinary perturbation expansion is suitable for strong coupling theories, ordinary local field theories as well as dual models. (NL)

11161 ADLER'S THEOREM IN FINITE MASSLESS QED AND POSSIBLE EXTENSIONS TO NON-ABELIAN GAUGE THEORIES. Bernstein, J. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 95: No. 3, 461-476(8 Sep 1975).

A new proof of Adler's theorem in finite massless QED is given and generalizations to non-Abelian gauge theories are studied. (NL)

11162 POSSIBLE COSMOLOGICAL ORIGIN OF SPONTANEOUS SYMMETRY BREAKING. Domokos, G.; Janson, M. M.; Kovesi-Domokos, S. (John Hopkins Univ., Baltimore). Nature (London); 257: No. 5523, 203-205(18 Sep 1975).

It is stated that popular unified theories of weak and electromagnetic interactions are based on the notion of a spontaneously broken gauge symmetry, and the hope has been expressed that suitable generalization of such theories might account also for strong interactions. It is here proposed that the spontaneous breakdown of gauge symmetries may have a cosmological origin, and that at some early stage of development of an expanding universe a phase transition occurs. Before the phase transition weak and electromagnetic interactions (and perhaps strong interactions) are of comparable strengths. Observed differences in the strengths of the various interactions develop only after the phase transition has taken place. This suggestion is treated mathematically. (UK)

11163 FIELD OF A ROTATING CHARGED BODY EMITTING NULL FLUID. Patel, L. K.; Misra, M. (Gujarat Univ., Ahmedabad, India). 6: No. 3, 281-288(Jun 1975).

An exact solution of Einstein's equation for an electromagnetic field plus pure radiation is given in terms of the Kerr-Schild metric. The radiating Kerr solution and the Debney-Kerr-Schild solution are derived as particular cases. (auth)

11164 EXPLICIT CALCULATION VS. FORMAL PROOF CONCERNING UNITARITY VIOLATION OF UNIFIED THEORIES IN WU'S GAUGE. Hsu, J. P. (Univ. of Texas, Austin). Lett. Nuovo Cim.; 14: No. 12, 425-431(22 Nov 1975).

A formal proof and explicit check of unitarity for non-Abelian gauge theories with a particular bilinear gauge condition are presented. The theories are constructed within the Lagrange-multiplier formalism. It is concluded that the usual formalism for non-Abelian gauge theories is not completely satisfied because it leads to violation of unitarity when one uses the Wu-gauge condition. The Lagrange-multiplier formalism can reveal the stability of gauge conditions, if any, and has more general validity than the usual formalism. (JFP)

11165 LOW-FREQUENCY ASYMPTOTICS OF THE ELECTRODYNAMICAL GREEN FUNCTIONS. Peletminskii, S. V.; Prik-

hod'ko, V. I.; Shchelokov, V. S. (Kharkov State Univ.). Teor. Mat. Fiz.; 25: No. 1, 70-79(Oct 1975). (In Russian).

Low frequency asymptotics of the electrodynamical Green functions is studied. The interpretation of the pole terms, which are present in this asymptotics, is given. The unified system of the Maxwell equation and the hydrodynamic equations is deduced. (auth)

11166 SUPERLUMINAL TRANSFORMATIONS. Pahor, S.; Strnad, J. (Univ. of Ljubljana, Yugoslavia). Lett. Nuovo Cim.; 14: No. 12, 458-462(22 Nov 1975).

Real-valued four-vectors are used to present a construction which leads to two distinct superluminal transformations. The discussion is restricted to collinear motion. (JFP)

11167 ANOTHER WAY OF MAKING ROOM FOR PARTICLES OF ANY VELOCITY. Gonzalez Gascon, F. (CSIC, Madrid). Lett. Nuovo Cim.; 14: No. 2, 69-71(13 Sep 1975).

It is shown that there are ways of making room for velocities $v > \nu$ without introducing some unphysical features in the normal Lorentz transformations. A set of two formulas is given forming a group of real transformations, which could be useful in the consideration of particles of any velocity. (JFP)

Gravitation and General Relativity

Refer also to abstracts 10070, 11119, and 11163.

11168 (CNRS-CPT-75-P-698) IS PHYSICAL SPACE UNIQUE OR OPTIONAL. Ekstein, H. (Centre National de la Recherche Scientifique, 13-Marseille (France). Centre de Physique Theorique). Feb 1975. 19p. INIS.

There are two concepts of the physical space-time. One, S(F), is that of a fixed arena in which events take place. The other S(D), is that of a space-time shaped by events. The second depends on the state (initial conditions) or on the external field, the first does not. The main assertions of the present paper are: (1) the fixed space-time S(F) is neither incompatible with nor made superfluous, by Einstein's theory. S(F) is experimentally explorable, unique, and probably identical with Minkowski space M. (2) The dynamical space S(D) is largely optional. It can be chosen to be M, but the natural choice is Einstein's pseudo-Riemanian manifold. (FR)

11169 GAUGE IN GENERAL RELATIVITY. Cohn, J. (Univ. of Oklahoma, Norman). Gen. Relativ. Gravitation; 6: No. 2, 143-150(Apr 1975).

The view is taken that the field equations of general relativity, without a definition of congruence of length and time intervals at different events, are without physical content. The possibility is explored that the customary Einstein field equations are to be used but with a different congruence definition than is customary. When these resulting equations are, in turn, expressed with the customary congruence, they comprise a new set of field equations physically not equivalent to either Einstein's or Brans-Dicke's formulations of general relativity. Similarities with Einstein's and Brans-Dicke's formulations are discussed, and the possibility of experimental confirmation of these new equations is also briefly considered. (auth)

11170 LAGRANGIAN FORMULATION OF A GEOMETRICAL SCALAR-TENSOR THEORY OF GRAVITATION. Ross, D. K. (Iowa State Univ., Ames). Gen. Relativ. Gravitation; 6: No. 2, 157-164(Apr 1975).

The author's geometrical theory of the scalar-tensor gravitational field is extended by formulating it in terms of a Lagrangian. An exact solution of the coupled non-linear field equations for a static point mass is also presented. This theory which is conformally equivalent to the empty space Einstein equations predicts the same results for experiments as the usual theory of Brans and Dicke which has a non-zero energy momentum tensor. (auth)

11171 "ELECTRIC" AND "MAGNETIC" GRAVITATIONAL FIELDS IN VACUUM. Tchrakian, D. H. (Saint Patrick's Coll., Maynooth, Ireland). Gen. Relativ. Gravitation; 6: No. 2, 151-156 (Apr 1975).

Gravitational tensor fields E_{ij} and H_{ij} in vacuum are introduced and the case of radiation is formulated, in analogy with electromagnetism. (auth)

11172 METRIC GRAVITATION WITH A TWO PARAMETER FAMILY OF STATIC SPHERICALLY SYMMETRIC SPACE-TIME. Camenzind, M.; Camenzind, M. A. (Univ., Bern). Gen. Relativ. Gravitation; 6: No. 2, 175-196(Apr 1975).

Among the variety of all conceivable metric theories of gravitation, Lorentz curvature dynamics is the most geometric extension of Einstein's field equations to fit the solar system data. In this framework two parameters determine the asymptotic form of a static spherically symmetric space-time (without imposing Einstein's conditions); these two parameters are the active gravitational mass of the source and the PPN parameter. The Lorentz connection is shown to satisfy covariant evolution equations which preserve either of these two parameters; furthermore, right and left oriented space-times differ in their Lorentz connection. Deviations from the Schwarzschild character find an interpretation in terms of a new object, the Lorentz curvature energy-momentum tensor, which always vanishes identically under the restriction of Einstein's conditions. These deviations contribute strongly to the gravitational force only in the neighborhood of the Schwarzschild sphere. (auth)

11173 EQUATIONS OF HYDRODYNAMICS IN GENERAL RELATIVITY IN THE SLOW MOTION APPROXIMATION. Anderson, J. L. (Inst. of Tech., Hoboken, NJ); Decanio, T. C. Gen. Relativ. Gravitation; 6: No. 2, 197-238(Apr 1975).

By means of a formal solution to the Einstein gravitational field equations a slow motion expansion in inverse powers of the speed of light is developed for the metric tensor. The formal solution, which satisfies the deDonder coordinate conditions and the Trautman outgoing radiation condition, is in the form of an integral equation which is solved iteratively. A stress-energy tensor appropriate to a perfect fluid is assumed and all orders of the metric needed to obtain the equations of motion and conserved quantities to the $2\frac{1}{2}$ post-Newtonian approximation are found. The results are compared to those obtained in another gauge by Chandrasekhar. In addition, the relation of the fast motion approximation to the slow motion approximation is examined. (auth)

11174 CONJECTURE ABOUT GRAVITATIONAL RADIATION IN ALL VIABLE GRAVITATIONAL THEORIES. Ni, W. T. (California Inst. of Tech., Pasadena). Chin. J. Phys. (Taiwan); 13: No. 1, 84-86(Apr 1975).

From regional conference on relativity, under the title Gravitational Radiation in Brans-Dicke Theory; Pittsburgh, PA, USA (13 Jul 1970).

A plausible demonstration of the conjecture that in all viable gravitational theories the energy loss rates for slow moving, nearly Newtonian systems are of the same order as in Einstein's general relativity is formulated and given. (auth)

11175 LAGRANGIAN DYNAMICS OF SPINNING PARTICLES AND POLARIZED MEDIA IN GENERAL RELATIVITY. Bailey, I. (Alberta Univ., Edmonton (Canada). Dept. of Mathematics); Israel, W. (Alberta Univ., Edmonton (Canada). Dept. of Physics). Commun. Math. Phys.; 42: No. 1, 65-82(May 1975).

35 refs.

The general form of the Lagrangian equations of motion is derived for a spinning particle having arbitrary multipole structure in arbitrary external field. It is then shown how these equations, together with the complete system of field equations can be recovered from a four dimensional action integral representing a polarized dustlike medium interacting with an arbitrary set of fields. These general results are then specialized to the case of Einstein-Maxwell fields in order to obtain the general-relativistic extension of Lorentz's dielectric theory. (auth)

11176 THE WEYL TENSOR AND SHEAR-FREE PERFECT FLUIDS. Glass, E.N. (Department of Physics, University of Windsor, Windsor, Ontario N9B 3P4, Canada). J. Math. Phys. (N.Y.) 16: No. 12, 2361-2363 (Dec 1975).

It is proved that a necessary and sufficient condition for a shear-free perfect fluid to be irrotational is that the Weyl tensor be pure electric type. For shear-free isentropic flow with unit tangent u^a, we find the conservation law $\nabla_a(n^{1/3} i\omega\ u^a) = 0$, where i is the relativistic specific enthalpy, n is the conserved particle number density, and ω is the vorticity scalar. (auth)

11177 SINGULARITIES IN NONSIMPLY CONNECTED SPACE-TIMES. Gannon, D. (Department of Mathematics, University of California, Davis, Davis, California 95616). J. Math. Phys. (N.Y.) 16: No. 12, 2364-2367 (Dec 1975).

Space-times with asymptotically flat nonsimply connected spacelike slices are shown to possess enough intrinsic geometric structure to guarantee the existence of singularities under conditions usually considered insufficient. In particular, it is shown that if the normal geodesics to the spacelike slice are converging on a suitable compact set, and the space-time satisfies a standard energy condition, then it is timelike geodesically incomplete. A similar result holds if the space-time satisfies the chronology and generic conditions. (auth)

11178 LORENTZ COVARIANT TREATMENT OF THE KERR-SCHILD GEOMETRY. Gürses, M.; Gürsey, F. (Physics Department, Yale University, New Haven, Connecticut 06520). J. Math. Phys. (N.Y.) 16: No. 12, 2385-2390 (Dec 1975).

It is shown that a Lorentz covariant coordinate system can be chosen in the case of the Kerr-Schild geometry which leads to the vanishing of the pseudo energy-momentum tensor and hence to the linearity of the

Einstein equations. The retarded time and the retarded distance are introduced and the Liénard–Wiechert potentials are generalized to gravitation in the case of world-line singularities to derive solutions of the type of Bonnor and Vaidya. An accelerated version of the de Sitter metric is also obtained. Because of the linearity, complex translations can be performed on these solutions, resulting in a special relativistic version of the Trautman–Newman technique and Lorentz covariant solutions for spinning systems can be derived, including a new anisotropic interior metric that matches to the Kerr metric on an oblate spheroid. (auth)

11179 SOME SOLUTIONS OF COMPLEX EINSTEIN EQUATIONS. Plebañski, J.F. (Centro de Investigación y de Estudios Avanzados del I.P.N., AP 14-740, México 14, D.F., Mexico). J. Math. Phys. (N.Y.) 16: No. 12, 2395-2402 (Dec 1975).

Complex V_4's are investigated where $\Gamma^{\dot{A}}_{\dot{B}\dot{C}} = 0$ and therefore *a fortiori* equations $G_{ab}=0$ are fulfilled. A general theory of spaces of this type is outlined and examples of nontrivial solutions of all degenerate algebraic types are provided. (auth)

11180 NULL GEODESIC SURFACES AND GOLDBERG-SACHS THEOREM IN COMPLEX RIEMANNIAN SPACES. Plebañski, J.F. (Centro de Investigación y de Estudios Avanzados del IPN, México 14, D.F., Mexico); Hacyan, S. J. Math. Phys. (N.Y.) 16: No. 12, 2403-2407 (Dec 1975).

An extension of the Goldberg–Sachs theorem for the case of a complex V_4 is given with a simple proof. The interpretation of the theorem, however, no longer applies the concept of the geodesic and shearless congruence of null directions; instead, the existence of a geodesic 2-surface (complex), the tangent vectorial space to which (i) contains only null vectors, (ii) is parallelly propagated along the surface, is now essential. (auth)

11181 SOLUTIONS FOR THE GENERAL CYLINDRICALLY SYMMETRIC STATIONARY DUST MODEL. Zimmerman, J.C. (Department of Physics and Astronomy, Clemson University, Clemson, South Carolina 29632). J. Math. Phys. (N.Y.) 16: No. 12, 2458-2460 (Dec 1975).

For a dust-filled space–time possessing cylindrical symmetry, the field equations form an underdetermined set. As demonstrated by King [Commun. Math. Phys. 38, 157 (1974)], by carefully selecting a function it is possible to generate solutions which are either well-behaved or are characterized by one of a number of different types of singularity. The three particular choices for the functions we take produce two nonsingular solutions and one with a Weyl singularity. (auth)

11182 CYLINDRICALLY SYMMETRIC SOLUTIONS OF A SCALAR–TENSOR THEORY OF GRAVITATION. Singh, T. (Department of Mathematics, University of Gorakhpur, Gorakhpur 273001, India). J. Math. Phys. (N.Y.) 16: No. 12, 2517-2519 (Dec 1975).

The cylindrically symmetric solutions for the Einstein–Rosen metric of a scalar–tensor theory proposed by Dunn have been obtained. A method has been given by which one can obtain, under certain conditions, solutions of this scalar–tensor theory from known solutions of the empty space field equations of Einstein's theory of gravitation. It is also found that one of the solutions of the scalar–tensor theory is nonsingular in the sense of Bonnor. Further some special solutions are obtained which reduce to the well-known solution of Levi-Civita and a time dependent solution obtained by Misra and Radhakrishna. (auth)

11183 LOCAL AND COVARIANT QUANTIZATIONS OF LINEARIZED EINSTEIN'S EQUATIONS. II. Bracci, L. (Istituto di Fisica dell'Università, Pisa, Italy); Strocchi, F. J. Math. Phys. (N.Y.) 16: No. 12, 2522-2526 (Dec 1975).

The local and covariant quantizations of the linearized Einstein's equations, in which the space–time translations may not commute with the metric operator, are analyzed. A general characterization of the subspace H' of physical vectors is given in terms of the two point function, independently of the Fock space representation of the gravitational potential $h_{\mu\nu}$. Under very general conditions all the H' are found to coincide with that of the Gupta formulation, thus showing that the physical content is the same as in the Gupta case. The analog of the Landau gauge in quantum gravity is defined and explicitly constructed through a Fock space representation of $h_{\mu\nu}$. Spinless gravitons can occur only in a quantization which exhibits unconventional features. (auth)

11184 MACH'S PRINCIPLE IN NEWTONIAN COSMOLOGY. Anile, A. M. (Univ. of Calabria, Cosenza, Italy). Nuovo Cim.; 29B: No. 1, 31-38(11 Sep 1975).

Mach's principle is formulated in the framework of Newtonian cosmology, following in part Raine's formulation of Mach's principle in general relativity. A complete characterization of Newtonian universes satisfying Mach's principle is given. One of the main consequences of the formulation is that if a Machian Newtonian universe is homogeneous, it must be isotropic. This has a counterpart in Raine's relativistic theory. (auth)

11185 RADIATION, PHOTON ORBITS, AND TORSION IN STRONGLY CURVED SPACETIMES. Sandberg, V. D. Salt Lake City; Univ. of Utah (1975). 81p. University Microfilms Order No. 75-23,821.

Thesis (Ph. D.).

Four topics on the strong field aspects of general relativity are presented. These are the role of constraining forces for ultra-relativistic particle motion as a source of gravitational radiation, the study of electromagnetic radiation due to space-time oscillations, the light scattering properties of a class of naked singularities, and the relation of gravitation theories with torsion to general relativity. The astrophysical implications and unusual physical phenomena associated with very intense gravitational fields are discussed for these four topics. (Diss. Abstr. Int., B)

11186 BI-METRIC THEORIES OF GRAVITATION. Liebscher, D. E. (Akademie der Wissenschaften der DDR, Potsdam, Ger.). Gen. Relativ. Gravitation; 6: No. 3, 277-280(Jun 1975).

The bi-metric theory recently proposed by Rosen (Gen. Rel. Grav.; 4: 435 (1973)) is examined in the case of superdense static objects. (auth)

11187 DISPERSION AND GIBBS PHENOMENON ASSOCIATED WITH DIFFERENCE APPROXIMATIONS TO INITIAL BOUNDARY-VALUE PROBLEMS FOR HYPERBOLIC EQUATIONS. Chin, R. C. Y. (Univ. of California, Livermore). J. Comput. Phys.; 18: No. 3, 233-247(Jul 1975).

One analyzes the problem of the semidiscretized approximation for the initial boundary-value problem of the wave equation. Point-wise convergence properties for the propagation of discontinuities are investigated via a uniformly valid asymptotic expansion. An approximate error analysis using matched asymptotic expansions is constructed and compared with the asymptotic expansion of the exact solution. (auth)

11188 IMPOSSIBILITY OF COLLAPSE UNDER THE LAW OF GRAVITATION R_{44} EQUALS 0. Kobus, J. P. Found. Phys.; 5: No. 4, 649-654(Dec 1975).

Radial motion of a small point mass in the gravitational field of a large point mass is investigated for the law of gravitation R_{44} equals 0. When geodesic equations are expressed in terms of components of acceleration, it is found that the normally "attractive force" of gravitation gradually weakens as the large mass is approached, and becomes "repulsive" inside a critical nonsingular radius close to the origin of coordinates. A particle requires an infinite time to reach the origin, regardless of its initial distance. Gravitational collapse, or at least violent collapse, is thus precluded. (auth)

11189 KILLING VECTOR FIELDS AND THE EINSTEIN–MAXWELL FIELD EQUATIONS IN GENERAL RELATIVITY. Michalski, H.; Wainwright, J. (Waterloo Univ., Ont.). Gen. Relativ. Gravitation; 6: No. 3, 289-318(Jun 1975).

A number of theorems concerning nonnull electrovac space-times, that is space-times whose metric satisfies the source-free Einstein–Maxwell equations for some nonnull bivector F_{ij}, are presented. Firstly it is supposed that the metric is invariant under a one-parameter group of isometries with Killing vector field ξ. It is proved that the electromagnetic field tensor F_{ij} is invariant under the group, in the same sense that its Lie derivative with respect to ξ vanishes, if and only if the gradient α_i of the complexion scalar is orthogonal to ξ. It is also proved that if in addition ξ is hypersurface orthogonal, it is necessarily parallel to α_i. These results are used to generalize theorems of Perjes and Majumdar concerning static electrovac space-times. Secondly it is supposed that the metric is invariant under a two-parameter orthogonally transitive Abelian group of isometries. It is proved that in this case F_{ij} is necessarily invariant under the group. These results can be used to simplify many derivations of exact solutions of the Einstein–Maxwell equations. (auth)

11190 BI-METRIC THEORY OF GRAVITATION. Rosen, N. (Technion-Israel Inst. of Tech., Haifa). Gen. Relativ. Gravitation; 6: No. 3, 259-268(Jun 1975).

The bi-metric theory of gravitation proposed previously is simplified in that the auxiliary conditions are discarded, the two metric tensors being tied together only by means of the boundary conditions. Some of the properties of the field of a particle are investigated; there is no black hole, and it appears that no gravitation collapse can take place. Although the proposed theory and general relativity are at present observationally indistinguishable, some differences are pointed out which may some day be susceptible of observation. An alternative bi-metric theory is considered which gives for the precession of the perihelion $^{2}/_{3}$ of the value given by general relativity; it seems less satisfactory than the present theory from the aesthetic point of view. (auth)

11191 ROSEN'S BI-METRIC THEORY OF GRAVITATION. Yilmaz, H. (Perception Tech. Corp., Winchester, MA). Gen. Relativ. Gravitation; 6: No. 3, 269-276(Jun 1975).

The field equations of Rosen's bi-metric theory of gravitation (Gen. Rel. Grav.; 4: 435(1973)) are solved exactly. The solutions are the same as in the theory of gravitation. These solutions are, however, incompatible with Rosen's conservation laws and his second (flat) metric. Incompatibility with the conservation laws arises in second order. Incompatibility with the flat metric arises in first order but only for time-dependent fields. Rosen's theory is defensible only as a static first order theory and predicts the red-shift light deflection and time-delay correctly. (auth)

11192 THEORY OF INERTIAL GRAVITATIONAL FIELDS. Raigorodski, L. D. (Leningrad Shipbuilding Inst.). Gen. Relativ. Gravitation; 6: No. 3, 243-252(Jun 1975).

The generalized equations of the inertial gravitational field are derived from variational principles. It is shown that variational properties of inertial gravitational potentials have important peculiarities which cause peculiarities of equations obtained. (auth)

11193 FUNDAMENTAL GROUPS OF SPACE–TIME IN GENERAL RELATIVITY. Lee, K. K. (Syracuse Univ., NY). Gen. Relativ. Gravitation; 6: No. 3, 239-242(Jun 1975).

It is shown that there are upper bounds on the first and second betti numbers of compact space-times or space-times with Cauchy surfaces whose fundamental groups are abelian. Homological classifications of compact space-times and space times with compact Cauchy surfaces are given. (auth)

11194 STRONG (f) GRAVITY, DIRAC'S LARGE NUMBERS HYPOTHESIS, AND THE EARLY HADRON ERA OF THE BIG-BANG UNIVERSE. Sivaram, C.; Sinha, K. P. (Indian Inst. of Science, Bangalore). JIISA; 57: No. 8, 257-269(Aug 1975).

The theory of f-gravity metric ($f_{\mu\nu}$) and the usual Einstein metric ($g_{\mu\nu}$) is shown to be connected with Dirac's recent suggestion of two metrics, i.e., an atomic metric in addition to the space-time metric. The large value of the f-gravity coupling constant $G_f \sim 10^{39}\ G_N$ (G_N being the Newtonian gravitational constant) provides the physical basis for Dirac's large numbers hypothesis. The cosmological consequences of the above theory for the early universe are discussed. The fine-structure constant and the strong interaction coupling constant appear as natural consequences of the initial conditions of the universe. (auth)

11195 SPACE–TIMES WITH GROUPS OF MOTIONS ON NULL HYPERSURFACES. Lauten, W. T. III; Ray, J. R. (Clemson Univ., SC) Lett. Nuovo Cim.; 14: No. 2, 63-66(13 Sep 1975).

The Einstein field equations for space–times admitting groups of motions acting on null hypersurfaces V_3^4 are discussed. As an example, the case G_4 VII on V_3^4 is considered. It is proven that this metric does not allow solutions for most of the simple energy–momentum tensors; vacuum, perfect fluid, electrovac, neutrino, scalar mesons, vector mesons, and massive fermions. (JFP)

11196 AXIALLY SYMMETRIC, STATIONARY SOLUTION OF EINSTEIN'S FIELD EQUATIONS. Gurses, M.; Guven, R. (Middle East Technical Univ., Ankara). Lett. Nuovo Cim.; 14: No. 2, 67-68(13 Sep 1975).

A new axially symmetric stationary solution of Einstein field equations for vacuum are presented starting with the general form of the line element. (JFP)

REACTOR TECHNOLOGY AND REGULATION

11197 (CEA-CONF-3013) NUCLEAR REACTORS: CHEMICAL ASPECTS OF THE FUEL CYCLE. Roth, Etienne. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Recherche et Analyse). 1975. 6p. (In French). INIS.

From 1st meeting of the solid-state chemistry and metallurgy prospective group; Paris, France (21 Jan 1975).

An attempt is made to show the importance of solid-state chemistry and metallurgy in nuclear industry: chemical plants associated with the fuel cycle; behavior of materials in reactors. (FR)

11198 (CEA-CONF-3020) NUCLEAR REACTORS: GENERAL POLICY AND CHOICE OF THE REACTOR TYPES. Rastoin, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service des Etudes Mechaniques et Thermiques). 1975. 12p. (In French). INIS.

From 1st meeting of the solid-state chemistry and metallurgy prospective group; Paris, France (21 Jan 1975).

The different nuclear reactor types (present and future), the possible uses of these reactors (electricity, heat production) and the chemical and metallurgical problems to be solved are discussed. (FR)

11199 (INDC(SEC)-46/U,R,F,S) WRENDA 75. World Request List for Nuclear Data Measurements: Fission Reactor Programs, Fusion Reactor Programs, Nuclear Safeguards Programs. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jun 1975. 209p. Dep. NTIS (US Sales Only) $8.75.

A listing of world requests for nuclear properties and reaction data for use in fission, fusion, and nuclear safeguards programs is compiled. (SDF)

11200 (INIS-mf-1759, pp 22-41) CENTRAL NUCLEAR POWER PLANTS FOR POWER AND STEAM GENERATION AND NUCLEAR BOILERS. Technical Feasibility and Economic Efficiency. Baturov, B. B.; Chernyaev, V. A.; Galaktionov, I. V.; Makarov, V. E.; Radchenko, S. V. 1974. (In Russian)

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In operating experience of nuclear plants and the future development of nuclear power production. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

The technical feasibility, economic conditions, and economic efficiency of supplying industrial and domestic heat from nuclear reactors are discussed. The study concentrated on the conditions in the European part of the USSR with consideration of the deficit in fossil fuels and the limitations on the possible extent of the inclusion of nuclear fuels in the fuel-energy balance of power engineering. It was assumed that the total volume of nuclear fuel included in the power engineering remains constant. Special attention was given to the possible fluctuations in fossil fuels, the capital investment, and the total normalized costs for the satisfaction of the fixed needs in heat and electrical energy with inclusion in the energy economy of these nuclear heat sources (tr-auth)

11201 (IRE-8/75-e) 10 YEARS INSTITUTE FOR REACTOR DEVELOPMENT. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorentwicklung). 1975. 119p. (In German). Dep. NTIS (US Sales Only) $5.50.

Ten years ago the Institute of Reactor Development was founded. A review is presented of the research work of the Institute in these past ten years. The work was mainly performed within the framework of the Fast Breeder Project, the Nuclear Safety Project, and Computer Aided Design. The following topics are discussed: design studies for different fast breeder reactors, development work for fast breeders, investigations of central safety problems of sodium cooled breeder reactors (such as local and integral coolant disturbances and hypothetical accident analysis), special questions of light water reactor safety (such as dynamic stresses in pressure suppression systems and fuel rod behavior under loss of coolant conditions), and computer application in various engineering fields. (auth)

11202 1975 DATF-KTG REACTOR CONFERENCE IN NUERNBERG. Henssen, H.; Rossbach, W. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Koeln (F. R. Germany)). Atomwirtsch., Atomtech.; 20: No. 7, 381-389(Jul 1975). (In German).

From reactor conference; Nuernberg, F. R. Germany (8 Apr 1975).

A comprehensive review on the meeting is given which reports on the most important of the 204 papers read in the four session groups: (1) reactor design and experiments, (2) fuel elements, fuel cycle, and isotope technique, (3) planning, construction and operation of nuclear reactor facilities and their components, and (4) reactor types and problems of cost-efficiency. (GE)

11203 NUCLEAR DISTRICT HEATING SYSTEMS. Winkens, H. P. (Energie- und Wasserwerke Rhein-Neckar A. G., Mannheim (F. R. Germany)). Atomwirtsch., Atomtech.; 20: No. 7, 375-380(Jul 1975). (In German).

From reactor conference; Nuernberg, F. R. Germany (8 Apr 1975). 9 figs.; 18 refs.

The energy requirement for heat generation by far exceeds the electricity requirement. For these reasons, and because of environmental pollution the possibility of supplying heat to households and to industry through a district heating network is now under intensive study. Preliminary results indicate that the central supply of heat from heating power plants is capable in the long run of greatly reducing the burden on our energy balance by utilizing the losses accompanying the generation of electricity. In addition, it would permit most of the energy requirement to be met from coal and, in particular, from nuclear power instead of oil. (GE)

11204 PROCESSES COUPLED TO HIGH TEMPERATURE REACTORS. Knizia, K. (Vereinigte Elektrizitaetswerke Westfalen A. G. (VEW), Dortmund (F. R. Germany)). Atomwirtsch., Atomtech.; 20: No. 7, 367-374(Jul 1975). (In German).

From reactor conference; Nuernberg, F. R. Germany (8 Apr 1975). 17 figs.

Future bottlenecks to be anticipated in the supply of a few fossil sources of primary energy necessitate some thinking about comprehensive energy systems capable of achieving a high degree of substitution of specific sources of primary energy by others. This requires coupling processes producing one or more secondary energies, which can be utilized additionally, from one or more primary energies. Such methods may be linked together, e.g., to form heat cascades and various conversions of matter to produce a variety of preliminary products and useful secondary energies. Coupling processes may be employed also to generate fissile materials from fertile ones for use in the production of various kinds of secondary energy in a variety of reactor systems. This enhances the economics of nuclear fuels by a combination of different types of nuclear power plants. The development of energy conversion systems so far has evolved a number of components to be integrated into an overall system which will help to use the primary energy available on a long term basis so as to generate a variety of secondary energies. The high temperature reactor is likely to play an important role in this system. (auth)

11205 OPERATING EXPERIENCE WITH NUCLEAR POWER INSTALLATIONS IN THE FEDERAL REPUBLIC OF GERMANY. Annual Report for 1974 of the ABE-Committee of Working Party I 'Engineering and Industry' of the German Atom Forum. At. Strom; 21: No. 5/6, 33-58(May 1975). (In German).

34 figs.; 3 tabs.

A comprehensive review is given of operational results achieved with the nuclear power stations functioning in the Federal Republic of Germany during 1974. (auth)

11206 FOUNDATIONS OF A LONG-TERM STRATEGY FOR NUCLEAR POWER DEVELOPMENT IN JAPAN. Murata, H. (Japan Atomic Energy Research Inst., Tokyo). Ann. Nucl. Energy; 2: No. 6, 495-501(Jul 1975).

A long-term strategy for nuclear power developments in Japan is proposed. The situation in the world has greatly changed in recent years due to the rise in oil prices as well as the considerable concern about environmental problems caused by nuclear power plants. Stress is being placed on environmental protection rather than on economical generation of nuclear power. In order to meet the future requirements, five systems are given for the short, medium, and long ranges beyond the year 2000. For the final stage a system is proposed that combines fusion-fission hybrid reactors with very high temperature gas cooled reactors to supply clean energy. (auth)

11207 NORTH CAROLINA STATE UNIVERSITY NUCLEAR POWER PLANT REACTOR OPERATOR TRAINING PROGRAMS. Berd, J. T.; Bohannon, J. R. Jr. (North Carolina State Univ., Raleigh). pp 46-47 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).

From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11208 WILL YOU NEED A NUCLEAR SIMULATOR. Ruzich, K. C. Electr. Light Power (Boston); 53: No. 9, 44-46(22 Sep 1975).

Information on nuclear power plant simulators is presented concerning simulator electronic equipment, training center complex; simulator cost; simulator training programs; initial reactor operator training program; operating plant training; and requalification training. (DCC)

11209 SUPPLEMENTARY QUALITY ASSURANCE REQUIREMENTS FOR INSTALLATION, INSPECTION, AND TESTING OF MECHANICAL EQUIPMENT AND SYSTEMS FOR THE CONSTRUCTION PHASE OF NUCLEAR POWER PLANTS. New York; American Society of Mechanical Engineers (1975). 18p.

Requirements for the installation, inspection, and testing that assure the quality of important components of a nuclear power plant during construction are presented. (JWR)

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 11328, 11332, 11337, 11342, 11348, 11386, and 11397.

11210 (ANCR-1259) INSPECTION SYSTEM FOR ZIRCALOY CLAD FUEL RODS. Yancey, M. E.; Porter, E. H.; Hansen, H. R. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Oct 1975. Contract E(10-1)-1375. 49p. Dep. NTIS $4.00.

A description is presented of the design, development, and performance of a remote scanning system for nondestructive examination of fuel rods. Characteristics that are examined include microcracking of fuel rod cladding, fuel-cladding interaction, cladding thickness, fuel rod diameter variation, and fuel rod bowing. Microcracking of both the inner and outer fuel rod surfaces and variations in wall thickness are detected by using a pulsed eddy current technique developed by Argonne National Laboratory (ANL). Fuel rod diameter variation and fuel rod bowing are detected by using two linear variable differential transformers (LVDTs) and a signal conditioning system. The system's mechanical features include variable scanning speeds, a precision indexing system, and a servomechanism to maintain proper probe alignment. Initial results indicate that the system is a very useful mechanism for characterizing irradiated fuel rods. (auth)

11211 (EUR-5374e) STRESS ANALYSIS OF BWR PRESSURE VESSEL NOZZLES. Blanckenburg, J.; Putzeys, J.; Reynen, J.; De Windt, P. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1975. 51p. Dep. NTIS (US Sales Only) $5.00. EUR FB 140,-.

The comparative analyses of BWR pressure vessel nozzles by means of finite elements are summarized. The study covers loadings by internal pressure and by thermal transients. 7 references. (auth)

11212 (ORNL-5059) TEST OF 6-INCH-THICK PRESSURE VESSELS. Series 2. Intermediate Test Vessels V-3, V-4, and V-6. Bryan, R. H.; Merkle, J. G.; Raftenberg, M. N.; Robinson, G. C.; Smith, J. E. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 275p. Dep. NTIS $7.60.

The second series of intermediate vessel tests were crack initiation fracture tests of 6-in.-thick 39-in.-OD steel vessels with sharp surface flaws approximately 2½ in. deep by 8 in. long in the longitudinal weld seams of the test cylinders. Fracture was initiated by means of hydraulic pressurization. One vessel was tested at each of three temperatures: 75, 130, and 190°F. Pretest analyses were made to predict the failure pressures and strains. Fracture toughness data obtained by equivalent-energy analysis of precracked Charpy-V tests and compact-tension specimen tests were used in the fracture analyses. The vessels behaved generally as had been expected. Posttest fracture analyses were also performed for each vessel. Detailed discussions of the fracture analysis methods developed in support of the vessel tests described are included. 34 references. (auth)

11213 CONDENSATE TREATMENT IN THE RWE-BAYERNWERK LTD. GUNDREMMINGEN NUCLEAR STATION. Durcak, H. (Kernkraftwerk RWE-Bayernwerk G.m.b.H., Gundremmingen/Guenzburg (F.R. Germany)); Schroeder, H. J. (Rheinisch-Westfaelisches Elektrizitaetswerk A. G., Riblis (F.R. Germany). Betriebsverwaltung). VGB Kraftwerkstech.; 55: No. 7, 453-455 (Jul 1975). (In German). 3 figs.; 5 tabs.; 1 ref.

The debate about the most effective method of condensate treatment, high plate filter or precoat filter with powder resins, is not yet over. The favorable experience obtained with the plant which has been in operation since 1968 at Gundremmingen is presented. (auth)

11214 CONTROL OF BWR POWER DISTRIBUTION. Kilian, P.; Pohl, P. (Kraftwerk Union A. G., Offenbach (F.R. Germany)). Atomkernenergie; 25: No. 2, 103-104(1975). (In German).

4 figs.; 6 refs.

In a boiling water reactor, the power distribution can be shaped by proper use of the control rods. Besides that they have to balance the effect of variable void content and, in the long run, to compensate burnup reactivity. In operation a constant target power distribution is maintained by multiple control rod configurations. Operation of the reactor core is assisted by the nuclear model process computer which constructs the power distribution from the output of the incore detectors. (auth)

11215 COMPARISON OF THEORETICAL AND EXPERIMENTAL RESULTS WITH RESPECT TO INCORE FUEL MANAGEMENT FOR VAK AND KRB. Lahner, K.; Wolf, R. (Nuklear-Ingenieur Service G.m.b.H., Hanau (F.R. Germany)). Atomkernenergie; 25: No. 2, 105-108(1975). (In German).

From KTG-special meeting "long-term behavior"; Stuttgart, F.R. Germany (25 Feb 1975). 9 figs.; 3 tabs.

The experiences gained in predicting the cycle length, the power density distribution, and the isotopic composition of discharged fuel elements for BWR power stations are described. The present effort is based on results obtained by a detailed analysis of 6 cycles for the VAK and KRB reactors. The difficulties in comparing measured and calculated results are discussed in detail. (GE)

11216 PLACE OF NUCLEAR POWER IN NORWAY'S FUTURE ENERGY SUPPLY. Tek. Ukebl.; 122: No. 30, 8-9(24 Jul 1975). (In Norwegian)

The Skiensfjord division of the Norwegian Engineers' Assn. (NIF) has set up a nine man study group, the conclusions of whose work are presented. The group was unanimous in recommending full exploitation of hydroelectric resources, taking reasonable environmental consideration. This will give an annual supply of 102 TWh in 1985, and will then be almost completely developed. The total demand in 1985, assuming a low prognosis 3.4% growth rate, will be 112 TWh. The majority (six) are of the opinion that the supplementary generating capacity should be nuclear, based on BWR and PWR type reactors. The minority regard the problems of waste disposal as not being capable of satisfactory solution and recommend the use of natural gas as fuel in thermal power plants to cover the period until the year 2000 when thermonuclear power will probably be feasible. (auth)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 11210, 11212, 11216, 11329, 11332, 11342, 11352, 11355, 11386, 11398, and 11399.

11217 (CENPD-170(Suppl.1)) ASSESSMENT OF THE ACCURACY OF PWR SAFETY SYSTEM ACTUATION AS PERFORMED BY THE CORE PROTECTION CALCULATORS (CPC). (Combustion Engineering, Inc., Windsor, Conn. (USA)). Nov 1975. 147p. Combustion Engineering, Inc., Windsor, CT.

Additional information is presented on the methods used in the Core Protection Calculators (CPC) to process sensor information and initiate a Low DNBR trip. A detailed examination of the uncertainties associated with the synthesis of the "static" DNBR and the ability with which the CPC's accommodate CEA misalignments are presented. The overpower margin uncertainty assigned to the CPC synthesized DNBR is given in each of nine regions of core operating space. The uncertainty in the region of normal operation is 2.6 percent at the 95/95 confidence level. (auth)

11218 (WCAP-8346(Rev.)) EVALUATION OF FUEL ROD BOWING. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). 1975. vp. Westinghouse Electric Corp., Pittsburgh, PA.

A previous model for predicting rod bow and its effect on DNB and power peaking in PWR type reactors is revised. (JWR)

11219 CALCULATION OF THE REACTIVITY OF THE KWO REACTOR DURING THE FIRST CYCLE. Lutz, D. C. (Stuttgart Univ. (TH) (F.R. Germany). Inst. fuer Kernenergetik). Atomkernenergie; 25: No. 2, 85-86(1975). (In German).

From KTG-special meeting "long-term behavior"; Stuttgart, F.R. Germany (25 Feb 1975). 1 fig.; 1 tab.; 17 refs.

The effort to reproduce the measured shape of the critical boron concentration of a pressurized water reactor during the first cycle starting from basic data (ENDF/B II) is described. The overall

results are satisfactory. There are some differences up to 80 ppM, which are partially explained by the calculation methods. (auth)

11220 PERFORMANCE OF THE COMBUSTION ENGINEERING PWR PHYSICS DESIGN SYSTEM. Gavin, P. H.; Rickard, I. C. (Combustion Engineering, Inc., Windsor, Conn. (USA). Nuclear Power Dept.). Atomkernenergie; 25: No. 2, 87-90(1975).

From KTG-special meeting "long-term behaviour"; Stuttgart, F.R. Germany (25 Feb 1975). 3 figs.; 7 tabs.; 9 refs.

The calculational system in use at Combustion Engineering for PWR physics design work comprises a number of computer codes for the determination of the spectral and spatial distributions of the neutron population and for the fuel depletion calculations. The theoretical and experimental work performed to date has established that this design system is quite adequate for the reliable and safe design of large pressurized water reactors, as exemplified by the results obtained in the analysis of experimental data collected on operating reactors. (auth)

11221 PREDICTION OF PHYSICS DATA REQUIRED BY REACTOR OPERATION. Schenk, H.; Pickel, E.; Sommer, D. (Kernkraftwerk Obrigheim G.m.b.H., Obrigheim/Mosbach (F.R. Germany)). Atomkernenergie; 25: No. 2, 75-83(1975). (In German).

From KTG-special meeting "long-term behavior"; Stuttgart, F.R. Germany (25 Feb 1975). 14 figs.

Reactor operation is correlated to a set of reactor data, in connection with other important operation parameters. Therefore, accuracy specifications are only possible for a few special values. In this respect, one of the most important aspects is the prediction of the power density distribution. It is shown that for constant power operation it is necessary to require an accuracy of 15% for the power density in normal cases, and an accuracy of 7% in special situations of operation with constant power (insertion of a control rod). The accuracy prediction of the power distribution during operation with xenon-transients and load-follow operation must be identical with present accuracy of the reactor instrumentation, i.e., ±5%. The data due to reactivity behavior of the core must be known to such a degree of accuracy that the total reactivity balance can be reliably evaluated. The long-time behavior of a core is characterized by burnup and cycle-length. The average burnup of a fuel element should be predicted with an accuracy of 5%. For economic reasons the evaluation of the cycle length should be in the range of ±10 full power days. (auth)

11222 TIMELY PLANNING CUTS NUCLEAR DOWNTIME. Morris, K. J. (Omaha Public Power District); Miller, A. K.; Novelline, J. A. Jr.; Schoenbrunn, A. G. Electr. World; 184: No. 11, 28-31(1 Dec 1975).

A description is given of the activities associated with the first-cycle refueling of the Calhoun-1 reactor. Included are comments on pre-outage activities, critical path planning, outage organization, quality assurance and control, health physics, outage conduct, and post-outage analysis. (DG)

11223 COMMISSIONING OF UNIT A OF THE BIBLIS NUCLEAR POWER STATION. Ritter, M.; Wienken, P. (Bundesministerium fuer Forschung und Technologie, Bonn). Nucl. Eng. Int.; 20: No. 233, 615-617(Aug 1975).

Preparing Biblis A for operation represented the first commissioning of a nuclear power unit with an electrical power output rating as high as 1200 MW(e). Although many of the individual commissioning steps, performance tests, measurements, and inspections were basically similar to those when commissioning earlier PWR plants, the schedule was more extensive and time consuming because, owing to its power rating, Biblis has to be treated to some extent as a prototype. (auth)

11224 BIBLIS NUCLEAR STEAM SUPPLY SYSTEMS. Huttach, A.; Putschogl, G.; Ritter, M. (Kroftwerk Union AG, Erlanger, Ger.). Nucl. Eng. Int.; 20: No. 233, 612-615(Aug 1975).

The Biblis nuclear steam supply is a continued development of previous German PWR plants, the only changes being those derived from operating experience or increased safety requirements. An outline is given of the Biblis-A reactor core, fabrication and erection of the pressure vessel and primary system, and safety related systems. To preclude elimination of functions due to accidents, the safety related systems are divided into four self contained and widely separated partial systems. The principle of operation of the ECCS is described. (UK)

11225 OVERALL PLANT CONFIGURATION: BIBLIS NUCLEAR POWER STATION. Fruehauf, H. (Hochtief AG, Frankfurt am Main); Lepie, C. Nucl. Eng. Int.; 20: No. 233, 607-612(Aug 1975).

The Biblis nuclear power plant with its two PWR units, 1200 MW(e) gross for unit A and 1300 MW(e) gross for unit B will be the world's largest nuclear station. The increase in output of 100% compared with the Stade plant involves changes of main design and constructional features. Descriptions are given, for Biblis B, of the site and plant arrangement, features of the coolant system, size of electrical equipment, and principles of the control systems. The arrangement of components within the reactor building and auxiliary buildings is explained. Reference is also made to various safety aspects of civil engineering work. (UK)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstracts 11204, 11338, and 11388.

11226 (AECL-5124, pp 45-56) CONCEPTUAL DESIGN OF IN-CORE NEUTRON MONITORING SYSTEMS FOR HTGR's. Loving, J. J. (United Engineers and Constructors, Inc., Philadelphia). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

The design in-core neutron monitoring for HTGRs would consist of two separate systems. Periodic full-core flux mapping would be performed by moveable neutron detectors routed through vertical flux paths. On-line monitoring would be done by a system of detectors in pre-selected flux paths which would automatically make axial profiles frequently. The system is described, and problems with detector design and operation in the high temperature environment are discussed. (HDR)

11227 (CONF-751101-38) DEVELOPMENT OF A RECYCLE FUEL FOR THE HTGR. Homan, F. J.; Long, E. L. Jr.; Beatty, R. L. (Oak Ridge National Lab., Tenn. (USA)). 1975. 5p. Dep. NTIS $4.50.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

A Weak-Acid Resin-derived (WAR) kernel has been selected as the new reference recycle fuel, and the irradiation program reoriented toward establishing optimum specifications. The loaded resin is carbonized to a dispersion of UO_2 in carbon at about 1200°C. Continued heating to higher temperatures can convert the UO_2 to carbide, completely at 1800°C. Performance of WAR fuels at three levels of conversion is compared. 5 references (auth)

11228 (GA-A-13175) INVESTIGATION INTO THE CAUSE AND CONSEQUENCE OF THE FORT ST. VRAIN PELTON WHEEL INCIPIENT FRACTURES. Supplement 1. (General Atomic Co., San Diego, Calif. (USA)). 14 Nov 1975. Contract E(04-3)-633. vp. Dep. NTIS $4.00.

New Pelton wheels have been successfully machined from forged Inconel 718 billets and installed in the FSV circulators. In comparison with cast Inconel 718, the wrought version offers both higher mechanical properties and improved fatigue fracture resistance. Further evidence is now available supporting the contention that: (1) the fatigue cracking of the cast Pelton wheel buckets was a consequence of their powered operation with water at speeds in excess of 10,000 rpm, and (2) the fatigue cracking of the cast Pelton wheel curvic couplings resulted from operation at the Valmont site with abnormal steam conditions. It is recommended that: (1) the wrought Pelton wheel be accepted for continuous operation at any speed up to 8000 rpm, and (2) the overspeed trip setting be set at 8800 rpm. This will provide adequate operating margin above the 8000 rpm maximum continuous speed. The Pelton wheels will be protected from structural damage if an overspeed condition should occur. (auth)

11229 (GA-A-13602) OPERATIONAL TESTING HIGHLIGHTS OF FORT ST. VRAIN. Cadwell, J. J.; McEachern, D. W.; Read, J. W.; Simon, W. A.; Walker, R. F. (General Atomic Co., San Diego, Calif. (USA)). 29 Sep 1975. Contract E(04-3)-633. 19p. (CONF-751007-7). NTIS $4.50.

From IAEA international meeting on gas-cooled reactors; Julich, F. R. Germany (13 Oct 1975).

The Fort St. Vrain program has progressed through construction, preoperational testing, fuel loading, initial criticality, and operational testing at power levels up to 2 percent related power. To date, all tests necessary before the rise to full power have been completed, and the rise-to-power program is expected to be resumed again in late 1975. Major plant systems, including the prestressed concrete reactor vessel and circulators, have demonstrated adequate performance. Extensive tests on the reactor core

at zero power and up to 2 percent power have demonstrated the accuracy in the design predictions of such core characteristics as critical rod position, control system worths, neutron flux distributions, and temperature coefficients. Gaseous fission product release measurements to date have confirmed the extensive analytical estimates. 6 references (auth)

11230 (GA-A-13671) COMPONENT AND SYSTEMS DEVELOPMENT PROGRAM. Quarterly Progress Report for The Period Ending September 30, 1975. (General Atomic Co., San Diego, Calif. (USA)). 31 Oct 1975. Contract E(04-3)-167. 72p. Dep. NTIS $5.45.

The objectives of the program reported are to provide a data base for the properties of materials used in the noncore construction of important components of the HTGR; to demonstrate the adequacy of the thermal barrier design in two critical areas: (1) fatigue life of attachment fixtures and (2) resiliency of insulation under vibration; and to investigate control and instrumentation systems associated with the safe operation of the HTGR. (auth)

11231 (KFK-2213) BEHAVIOR OF FISSION PRODUCTS IN HIGHLY BURNT HTR FUELS BY MICROPROBE ANALYSIS. Kleykamp, H. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Material- und Festkoerperforschung). Oct 1975. 41p. (In German). Dep. NTIS (US Sales Only) $4.00.

Electron microprobe analysis of irradiated coated particles with high burnups (>50% fima) gives detailed information on the chemical state and the transport behaviour of the fission products in UO_2 and UC_2 kernels and in the coatings. In oxide fuel kernels, metallic Mo-Tc-Ru-Rh-Pd and Pd-Te inclusions and ceramic $(Sr,Ba)\cdot(Zr,U,R.E.)O_x$ precipitations are observed. The solubility behaviour of the fission products in the fuel matrix has been investigated. Fission product inclusions could not be detected in carbide fuel kernels; post irradiation annealed UC_2 kernels, however, give information on the element combinations of some fission product phases. Corresponding to the chemical state in the kernel, Cs, Sr, Ba, Pd, Te, and the rare earths are released easily and diffuse through the entire pyrocarbon coating. These fission products can be retained by a silicon carbide layer. The initial stage of a corrosive attack of the SiC coating by the fission products is evidenced. (auth)

11232 ADVANCED SHUT-DOWN METHODS AND AFTER-HEAT REMOVAL POSSIBILITIES FOR HIGH-TEMPERATURE REACTORS WITH SPHERICAL FUEL ELEMENTS. Schweiger, F.; Wohler, J. (Hochtemperatur-Kernkraftwerk G.m.b.H. (HKG), Uentrop (F. R. Germany)). VGB Kraftwerkstech.; 55: No. 6, 364-372(Jun 1975). (In German)

The object of the methods described is to reduce the number of disturbances by smaller stresses on the reactor components and steam generator, as well as the shut-down time after disturbances. This is to achieve a better availability and greater profitableness as well as a safety improvement especially by smaller irradiation doses for the maintenance personnel. The presentation is based on the operational experience at the AVR. (GE)

11233 FIRST HELIUM TURBINE OF THE WORLD STARTED IN OBERHAUSEN-STERKRADE. Bammert, K. (Technische Univ. Hannover (F. R. Germany). Inst. fuer Stroemungsmaschinen). Energiewirtsch. Tagesfragen; 25: No. 7, 299-314(Jul 1975). (In German)

3 figs.

The helium turbine of Energieversorgung Oberhausen AG (EVO) was started on December 19, 1974. Among the guests of honor were the Swiss professors Ackeret and Keller who had in 1935 claimed the patent rights for the closed gas turbine process. In the speech summarized in this article, Prof. Dr.-Ing. Bammert, head of the Institut fuer Stroemungsmaschinen of the Technische Universitaet Hannover, gives some comments on the project and describes the technical details of the helium plant. (auth)

11234 COMPARISON OF MEASUREMENTS AND CALCULATIONS OF CONTROL ROD EFFICIENCIES AT THE CRITICAL FACILITY TO THE HIGH-TEMPERATURE REACTOR (KATHER). Drueke, V.; Filges, D.; Gerwin, H.; Kirch, N.; Neef, R. D.; Scherer, W. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). Atomkerenergie; 25: No. 4, 276-280(1975). (In German)

3 figs.; 3 tabs.; 14 refs.

In the course of the critical experiment on the high-temperature reactor (KATHER) the efficiency of control rods has been investigated by detailed measurements and calculations. Various methods of measurements were used. The results were compared with theoretical calculations. Special interest was applied to the problem of comparing experimental and theoretical reactivity worths. (auth)

11235 HIGH-TEMPERATURE REACTORS AT VARIOUS FUEL CYCLES. Teuchert, E. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)); Brandes, S. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (F. R. Germany)). Atomkernenergie; 25: No. 2, 137-143(1975). (In German)

From KTG-special meeting "long-term behavior"; Stuttgart, F. R. Germany (25 Feb 1975). 3 figs.; 7 tabs.; 10 refs.

The high temperature reactors are marked by their flexibility for the application of different fuel cycles, which results from the neutronic properties of the fissile and fertile nuclides and from the technological and technical properties of the system. This holds as well for the pebble bed as for the prismatic fuel type reactor. In the low enriched uranium fuel cycle up to 89% of the bred fissile plutonium is burnt in situ. In the highly enriched uranium/thorium fuel cycle, recycling of the bred U 233 optimizes the economy of fissile material. The conversion rate can be raised up to the range between 0.85 and 0.95. A demonstration of the flexibility of the HTR's is given by the possibility for changing over between different fuel cycles at fuel operating conditions. (auth)

11236 PHYSICS DESIGN OF THE HTR-1160. Huebner, A.; Brandes, S. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (F. R. Germany)). Atomkernenergie; 25: No. 2, 144-148(1975). (In German)

From KTG-special meeting "long-term behavior"; Stuttgart, F. R. Germany (25 Feb 1975). 7 figs.; 2 tabs.; 8 refs.

The physics design of the reactor core of the helium cooled, graphite moderated high-temperature reactor HTR-1160 is described. A discussion is given of the design criteria, the calculational methods, the burnup cycle, the power distribution and the reactivity control. (auth)

11237 REFUELING FLEXIBILITY OF THE THTR-300 AFTER SHUT-DOWN PERIODS. Gutsch, U.; Patscher, W. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (F. R. Germany)). Atomkernenergie; 25: No. 2, 133-136(1975). (In German)

From KTG-special meeting "long-term behavior"; Stuttgart, F. R. Germany (25 Feb 1975). 6 figs.; 1 ref.

The design of the THTR-pebble bed reactor is based on the thorium-uranium fuel cycle with continuous refueling. Under steady operating conditions the core is in an equilibrium state with stationary isotopic densities. During an extended shut-down period, however, the protactinium, which is bred from thorium, decays into fissile U 233. This decay produces an excess reactivity, which after restarting reduces relatively slowly during the normal refueling. This can be used to obtain a greater flexibility in the refueling strategy. It will be shown that the reactor after a shut-down period can be operated for several days or weeks with reduced or without any fueling. Such modifications of the fueling mode have no serious consequences on the axial core composition or the reactivity behaviour after the restart of fueling. In addition the modified fueling strategies are not expected to result in higher temperatures for the fuel elements. This can be used to start the reactor up again after a shut-down period, even if the refueling circulating system is not yet available or only available for limited periods. (auth)

11238 PHYSICAL BEHAVIOR OF THE AVR-REACTOR WITH INSERTION OF SUBSTANTIAL AMOUNTS OF THTR 300 FUEL ELEMENTS. Maly, V.; Wahl, D.; Wagemann, R. (Arbeitsgemeinschaft Versuchs-Reaktor G.m.b.H., Juelich (F. R. Germany)). Atomkernenergie; 25: No. 2, 129-132(1975). (In German)

4 figs.; 2 tabs.; 4 refs.

The AVR-reactor allows extensive testing of fuel elements of the pebble-bed type under conditions similar to power operation. Due to the statistical character of fuel element circulation an extensive computational support in planning and performing of such tests is necessary, especially if the test fuel elements cause a substantial change of core parameters. The problems arising from the insertion of substantial amounts of THTR 300 fuel elements are discussed. It appears that the AVR-reactor can be operated with THTR fuel elements, but some restrictions of the test objectives would be necessary. (auth)

11239 RUNNING-IN PHASE OF THE HTR-1160. Kostner, F.; Huebner, A.; Brandes, S. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (F. R. Germany)). Atomkernenergie; 25: No. 2, 149-152(1975). (In German)

9 figs.; 4 refs.

The physics design of the HTR-1160 reactor core is based on the annual reload and fuel lifetime of four years. The running-in phase from the initial core up to the equilibrium core is surveyed. (auth)

11240 INFLUENCE OF POWER DENSITY AND BURN-UP DISTRIBUTIONS ON TEMPERATURE FIELDS OF PEBBLE-

BED CORES. Wahl, D.; Wagemann, R.; Maly, V. (Arbeitsgemeinschaft Versuchs-Reaktor G.m.b.H., Juelich (F. R. Germany)). Atomkernenergie; 25: No. 2, 125-128(1975). (In German)

From KTG-special meeting "long-term behavior"; Stuttgart, F. R. Germany (25 Feb 1975). 4 figs.; 2 tabs.; 4 refs.

The calculation of coolant gas flow and heat transfer in cores of pebble-bed reactors requires special treatment of the fluid dynamics equations. Errors of the approximations and influence of errors of the input data of the calculation are estimated. It can be seen that power density distribution has to be calculated better than 5% in order to get reasonable results from the calculations. Using for example certain parts of AVR reactor lifetime, the feasibility of influencing the temperature distribution of a pebble-bed reactor by fuel management is demonstrated. By choice of suitable measures, large effects can be obtained. (auth)

11241 LONG-TERM BEHAVIOR OF THE AVR-CORE. Wagemann, R.; Wahl, D.; Krueger, K. (Arbeitsgemeinschaft Versuchs-Reaktor G.m.b.H., Juelich (F. R. Germany)). Atomkernenergie; 25: No. 2, 115-124(1975). (In German)

From KTG-special meeting "long-term behavior"; Stuttgart, F. R. Germany (25 Feb 1975). 19 figs.; 7 tabs.; 15 refs.

The physics behavior of the AVR-reactor since 1967 is examined. At present the AVR is run at an average hot-gas temperature of 950°C, while originally designed or 850°C. The pebble-bed core consists of 7 different spherical fuel-element types. This mode of operation requires, in connection with the rather poor shutdown system and with regard to the statistical fuelling as well as the lack of in-core instrumentation, extensive reactor-following calculations. (GE)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstract 9955.

11242 (AECL-5124, pp 219-234) FAILED FUEL DETECTION METHODS FOR CANDU REACTORS. Lipsett, J. J. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Fuel failures are monitored in the CANDU reactors by measuring the concentrations of the gaseous fission products ^{135}Xe and ^{88}Kr. Failures are indicated by changes in both the magnitude of the individual concentrations and the $^{135}Xe/^{88}Kr$ ratio. The germanium spectroscopy system used for these measurements and some of the operating problems are described. (HDR)

11243 (AECL-5124, pp 243-246) DESIGN CONSIDERATIONS FOR FAILED FUEL LOCATION SYSTEM FOR ONTARIO HYDRO. Anderson, D. E. (Hydro Electric Power Commission, Sheridan Park, Ont.). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs).

Practical aspects of designing and installing failed fuel detection and monitoring systems on CANDU reactors are discussed. The safety and economics of a very coarse system based on coolant sampling are compared to those of a very expensive and very sensitive system based on delayed neutron monitoring. (HDR)

11244 (AECL-5124, pp 251-258) OPERATING EXPERIENCE WITH FAILED FUEL DETECTION AND LOCATION IN ONTARIO HYDRO. Turcotte, G. E. (Pickering Generating Station, Ont.). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed-fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Operating experience at Unit 1 of the Pickering station with defected fuel are reviewed. The number of confirmed defects after irradiating 30,000 fuel bundles is approximately 80. The operating history of defected bundles and the probable causes of the defect mechanisms are discussed. (HDR)

11245 APPLICATION OF SERPAN'S DAMAGE FUNCTION TO HEAVY-WATER MODERATED POWER REACTORS AND ITS CONTROL WITH SURVEILLANCE DATA OF THE KARLSRUHE POWER REACTOR, MZFR. Leitz, C. (Kraftwerk Union A. G., Erlangen (F. R. Germany). Reaktortechnik). Nucl. Eng. Des.; 33: No. 1, 30-36(Aug 1975).

For calculating ΔNDT, the irradiation-induced shift of the nil-ductility transition temperature, for the design of pressurized water reactor vessels, literature data envelope curves are used. In the case of light-water moderated reactors no correction of different spectra influence is considered. Calculations with the damage functions, published by Serpan et al., demonstrate that neglecting spectrum influence yields conservative design data. For heavy-water moderated reactors an adjusting factor is calculated from Serpan's damage function. The ΔNDT measured with samples of the ASTM reference steel A302-B irradiated in the heavy-water reactor, MZFR, is compared to irradiation results of samples from the same steel irradiated in the Oak Ridge Low Intensity Test Reactor (LITR) which are published by NRL. From this comparison an experimental adjusting factor is derived. Both calculated damage function and experimental factors agree very well. This result demonstrates that Serpan's damage function is applicable also to MZFR surveillance samples. The neutron spectrum in the MZFR surveillance location is extremely soft. Thermal neutron population is 900 times the fast flux (e > 0.9 MeV). Its damage contribution, calculated with damage function, amounts to 73%. (NL)

Power Reactors, Breeding

Refer also to abstracts 9403, 9770, 9957, 11333–11336, 11340, 11346, 11389, and 11395.

11246 (AECL-5124, pp 281-290) FAILED FUEL DETECTION AND LOCATION IN THE PROTOTYPE FAST REACTOR. Cartwright, D. K. (UKAEA, Risley, Eng.). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

The failed fuel detection systems have been incorporated into PFR as part of the reactor safety instrumentation to protect against accidents arising from coolant channel blockages, to assist reactor operation and to provide data for fuel performance studies. These systems are based on the detection of delayed neutrons and rare gas fission products leaking from failed fuel. A brief description of the systems is given together with a summary of development work in aid of design. The performance of the system is to be determined during reactor commissioning; however, an assessment of the expected performance suggests that the requirements of the system will be met provided the contamination of the system is kept low. (auth)

11247 (AECL-5124, pp 291-306) PFR BURST PIN DETECTION DISPLAY SYSTEM. Hodgson, D. (UKAEA, Risley, Eng.). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

The delayed neutron burst pin detection (BPD) system in the Prototype Fast Reactor is outlined, and the data display technique are described. The testing and commissioning of the plant hardware and computer software are examined. (HDR)

11248 (AECL-5124, pp 313-328) PHENIX REACTOR: EQUIPMENT FOR FUEL FAILURE DETECTION AND LOCATION. Chantot, M. P.; Pages, J. P.; Paziaud, A.; Rulleau, A. (Centre d'Etudes Nucleaires de Cadarache, France). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

The Phenix equipment for fuel failure location/fuel failure detection (FFL/FFD) is composed of a means of detection and an identification of fuel failure (delayed neutron monitoring and gas measurement) and a double means of location (FFL plug installed and gas tags under decision). Regarding the efficiency and accuracy of this equipment the initial results of operation look promising. (auth)

11249 (AECL-5124, pp 363-374) PFR BURST PIN DETECTION SYSTEM. Mitchell, C. H. Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

The monitoring equipment used in detecting and locating fuel failures in the Prototype Fast Reactor is described. The system operates by detecting delayed neutrons in coolant samples which are taken at the core outlet and the primary heat exchangers. A subsidiary system is used for monitoring fission product gas release which is accumulated in the reactor gas blanket or transported in the core outlet coolant samples. (auth)

11250 (ANL-RDP-44) REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, OCTOBER 1975. Sachs, R. G.; Kyger, J. A. (Argonne National Lab., Ill. (USA)). 5 Dec 1975. Contract W-31-109-Eng-38. vp. AT.

Progress is summarized in the following research and development areas: Experimental Breeder Reactor No. 2, Hot Fuel Examination Facility, LMFBR design support, instrumentation and control, fuels and materials development, reactor physics, reactor safety, energy and environmental systems, and other fast breeder reactors. (auth)

11251 (BLG-508) RESULTS OF FIVE YEARS OF BR2 REACTOR UTILIZATION. Proceedings of Symposium Held at Mol, Belgium, 4–5, December 1973. de Proost, M. (ed.). (Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (F.R. Germany); Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany); Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). 1973. 232p. (CONF-731234-).

The results of 5 years of joint utilization of the BR-2 reactor and its associated facilities at Mol are reviewed. The 22 papers presented deal with testing of fuel elements and materials for the LMFBR, gas cooled reactors, and water cooled reactors. Separate abstracts were prepared for each of 11 papers. Eleven papers were previously abstracted for NSA as 30: 14502; 14503; 14521; 14540; 14561; 14570; 14571; 14636; 14637; 14638; and 16393. (HDR)

For abstracts of individual papers see: 9895, 9896, and 11252–11260.

11252 (BLG-508, pp 63-73) GCFR-FUEL-ELEMENT-IRRADIATIONS IN THE GSB-He-LOOP-MOL. Euringer, H. (Kernforschungsanlage, Juelich, Ger.); Jung, W.; Debrue, J. 1973.

From symposium dealing with research and development work on the liquid metal cooled fast breeder reactor, the gas-cooled reactor and the water cooled reactor; Mol, Belgium (4 Dec 1973).

In results of five years of BR2 reactor utilization.

The Gas Cooled Fast Breeder with vented fuel elements can be considered as a promising alternative solution to Sodium Cooled Breeders. This variant of the GCFR needs the smallest amount of development-potential, considering that on one hand the He-plant is similar to that of HTRs, and on the other hand the fuel element development of the SNR can be applied. As part of the development of the vented fuel element, irradiation tests on fuel element bundles will be performed in the BR2 reactor in the so-called He-Loop Mol. These are the only in-pile tests which respect all the requirements of a GCFR-power plant, except the original fast neutron fluence. This will be realized by the following items: installation of a cadmium screen, assuring an epithermal to fast neutron flux; irradiation of a vented 12 rod-bundle with all essential characteristics and components of a GCFR fuel element; a fuel-element-venting-system together with a fission-gas-separator-system connected to the fuel element. The general aim of this test is a burn up to 60,000 - 100,000 $MWd.t^{-1}$ with a maximum rod power of 500 $W.cm^{-1}$ and a maximum cladding temperature of 700°C. Mainly the tests involve the irradiation behaviour of the vented fuel element bundles and the fuel-element-venting-system and its components. (auth)

11253 (BLG-508, pp 77-86) BETWEEN SCIENCE AND TECHNOLOGY: RESULTS AND REFLECTIONS ON THE STATUS OF FUEL ELEMENT DEVELOPMENT FOR FAST REACTORS. Karsten, G. (Kernforschungszentrum, Karlsruhe, Ger.). 1973.

From symposium dealing with research and development work on the liquid metal cooled fast breeder reactor, the gas-cooled reactor and the water cooled reactor; Mol, Belgium (4 Dec 1973).

In results of five years of BR2 reactor utilization.

The present special situation of the fuel element development for the SNR (Schneller Natriumgekühlter Reaktor) can be characterized as a status of transition from basic research to technological realization. This means that the next step will be the formulation of the specifications for the first load of fuel elements of the SNR-300. This paper describes the main areas of research and the results of the past years. Fuel, cladding, pin and the fuel element are the subjects of discussion. However, it is necessary to consider the strategy of the development requirements of fuel elements for commercial breeder reactors of the generation which follows the demonstration plants. (auth)

11254 (BLG-508, pp 113-120) EVALUATION OF POST-IRRADIATION EXAMINATION RESULTS ON UO_2–PuO_2 FUEL PINS. Dienst, W. (Kernforschungszentrum, Karlsruhe, Ger.). 1973.

From symposium dealing with research and development work on the liquid metal cooled fast breeder reactor, the gas-cooled reactor and the water cooled reactor; Mol, Belgium (4 Dec 1973).

In results of five years of BR2 reactor utilization.

The irradiation tests on UO_2-PuO_2 fuel pins are to identify the effects that could limit the lifetime of oxide fuel pins, and to quantitatively describe their dependence on the design data and irradiation conditions. Mol-7A and Mol-8B/C are part of these tests. This report covers results on fission gas behaviour, cladding plastic deformation and void volume redistribution. In the presentation of fission gas behaviour, the chief stress is laid on the measurement and general formulation of fission gas retention and the dependence on fuel burnup and temperature. Cladding diameter increase in BR2 tests is presented in comparison with other results to discuss the influence of fuel sintered density, burnup and cladding temperature. Some attention is given to the possible mechanism of cladding plastic deformation. Void volume redistribution was examined by measuring central hole diameter, gap width, crack width and radial porosity profile. Deviations between measured and computed results are discussed, and the possibility of irradiation-induced sintering is emphasized. (auth)

11255 (BLG-508, pp 121-134) LOOP IRRADIATION EXPERIMENTS MOL-7A AND MOL-7B. Kummerer, W. (Kernforschungszentrum, Karlsruhe, Ger.). 1973.

From symposium dealing with research and development work on the liquid metal cooled fast breeder reactor, the gas-cooled reactor and the water cooled reactor; Mol, Belgium (4 Dec 1973).

In results of five years of BR2 reactor utilization.

These experiments have been used for studying the behaviour of oxide fuel rod-bundles under irradiation in flowing sodium. In this way both the individual rods and the spacers etc. can be tested. The 250 kW in-pile Na-loop Mol-7A was finished in 1969 and the 500 kW in-pile Na-loop Mol-7B has been operating in BR2 since 1972. (auth)

11256 (BLG-508, pp 153-158) RESULTS FROM BR2 IRRADIATIONS CONCERNING FUEL/CLAD COMPATIBILITY. Goetzmann, O.; Kleykamp, H. (Kernforschungszentrum, Karlsruhe, Ger.). 1973.

From symposium dealing with research and development work on the liquid metal cooled fast breeder reactor, the gas-cooled reactor and the water cooled reactor; Mol, Belgium (4 Dec 1973).

In results of five years of BR2 reactor utilization.

An extensive evaluation of the compatibility behaviour between fuel and cladding was performed with pins of the experiment MOL-7A. Penetration depths of the inner cladding attack ranged up to 100 μm for cladding temperatures around 600°C, but at temperatures below 500°C practically no attack could be observed. These penetration depths are somewhat higher than those found for the same temperature in the pins irradiated in DFR. As the post-irradiation examination of the capsule experiment MOL-8B has shown, an increase in burnup will not necessarily result in increased cladding attack. The maximum penetration depths observed in the MOL-8B pin are 60-70 μm at pin positions where the inner wall temperature was around 620°C. The burnup reached in the MOL-8B experiment was almost twice as high as that of the MOL-7A experiment (85,000 $MWd.t^{-1}$ versus 45,000 $MWd.t^{-1}$). These results for cladding attack fit well into the picture of the compatibility situation of oxide pins recorded so far in the literature. The microprobe investigation of the MOL-7A pins revealed the presence of fission products in the reaction zones of the cladding. The microprobe analysis also dealt with the uranium-plutonium redistribution and the segregation of fission products in metallic and oxide inclusions in the fuel. (auth)

11257 (BLG-508, pp 159-165) IN-PILE FUEL CREEP EXPERIMENT (MOL-12) AND MECHANICAL INTERACTION FUEL/CLADDING EXPERIMENT (MOL-10). Brucklacher, D. (Kernforschungszentrum, Karlsruhe, Ger.). 1973.

From symposium dealing with research and development work on the liquid metal cooled fast breeder reactor, the gas-cooled reactor and the water cooled reactor; Mol, Belgium (4 Dec 1973).

In results of five years of BR2 reactor utilization.

Experimental investigations are reported on the mechanical fuel/cladding interaction, namely in-pile creep experiments on UO_2 and UO_2-PuO_2 fuel as well as rod power and temperature cycling experiments on short UO_2-PuO_2 fuel pins. (auth)

11258 (BLG-508, pp 167-171) IRRADIATION EXPERIMENTS MOL-8A AND MOL-8B. Weimar, P. (Kernforschungszentrum, Karlsruhe, Ger.). 1973.

From symposium dealing with research and development work on the liquid metal cooled fast breeder reactor, the gas-cooled reactor and the water cooled reactor; Mol, Belgium (4 Dec 1973).

In results of five years of BR2 reactor utilization.

Mol-8A was a capsule experiment series for studying the behaviour of long oxide fuel rods under irradiation in stagnant sodium. It served as a prototype for the series Mol-8B, 8C and 8D. Mol 8B, like Mol-8C, was a high burnup test for studying fuel swelling and fission gas release in capsules equipped with various instrumentation. (auth)

11259 (BLG-508, pp 173-176) LAYOUT, CONTROL, AND SURVEY OF THE IRRADIATION EXPERIMENT MOL-11. Freund, D. (Kernforschungszentrum, Karlsruhe, Ger.). 1973.

From symposium dealing with research and development work on the liquid metal cooled fast breeder reactor, the gas-cooled reactor and the water cooled reactor; Mol, Belgium (4 Dec 1973).

In results of five years of BR2 reactor utilization.

Mol 11 is a series of experiments for obtaining carbide fuel swelling data at high rod power (1300-1500 $W.cm^{-1}$) for gas as well as sodium bonding. (auth)

11260 (BLG-508, pp 227-232) IRRADIATION OF U(C,N) FUEL IN BR2 EXPERIMENTS. Pott, G.; Herren, M.; Naoumidis, A. (Kernforschungsanlage, Juelich, Ger.). 1973.

From symposium dealing with research and development work on the liquid metal cooled fast breeder reactor, the gas-cooled reactor and the water cooled reactor; Mol, Belgium (4 Dec 1973).

In results of five years of BR2 reactor utilization.

Since 1968 U(C,N) fuel pins have been tested in six experiments in BR2. Two additional tests are now under preparation. The existing irradiation facilities had to be modified for heat ratings of 1500 $W.cm^{-1}$ fuel pin length. In long term irradiations, a burnup of more than 50,000 $MWd.t_U^{-1}$ was achieved. The fuel irradiation behaviour was similar to results obtained for UC. (auth)

11261 (CEA-CONF-2984) MEASUREMENT OF THE VIBRATIONS OF THE INTERNAL STRUCTURES OF THE PHENIX REACTOR-BLOCK. Tigeot, Y.; Livolant, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service des Etudes Mecaniques et Thermiques). 1974. 20p. (In French). INIS.

From France-Soviet colloquium; Obninsk, USSR (7 Dec 1974).

Vibrational studies on the internal vessels of Phenix were conducted in three stages: tests on models; measurements of the characteristic modes and characteristic frequencies of the various reactor components during construction, in the absence of sodium, by mechanical excitation; and vibration measurements at the moment of start-up tests. The results obtained are reviewed. (FR)

11262 (CEA-CONF-2987) STUDY OF THE ACOUSTICAL EXCITATION OF BREATHING MODES OF THE MAIN VESSEL SHELL AND LOWER PRIMARY VESSEL SHELL OF THE REACTOR PHENIX. Gibert, R. J. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service des Etudes Mecaniques et Thermiques). 1974. 5p. (In French). INIS.

From France-Soviet colloquium; Obninsk, USSR (7 Dec 1974).

The sodium circuit of the reactor Phenix possesses a number of fluid flow singularities which induce noise sources transmitted in the form of sound waves throughout the circuit. The most important of these sources are probably located at the three pumps. The aim of this work was to determine, given a noise source at the level of the pumps, the resulting pressure fluctuation on the shells of the main vessel and primary vessel, with special reference to the break-down coefficients of this fluctuation on their characteristic breathing modes. (FR)

11263 (FRNC-TH-525) BLANKETS AND REFLECTORS OF REACTORS OF THE FAST-NEUTRON TYPE. Beltranda, G. (Grenoble-1 Univ., 38 (France)). 1974. 179p. (In French). Dep. NTIS (US Sales Only) $8.50.

Thesis. Submitted to Universite Scientifique et Medicale de Grenoble, France.

Reactor blankets were studied from the viewpoint of reflector breeding, power, Pu production, and γ heating. The experimental programs and the calculation methods used are first outlined. The problem of reflector breeding is considered particularly in the framework of results obtained in the determination of the critical mass of Phenix at start-up and at equilibrium and the corrections of the critical enrichments of Superphenix by the Laplacian-reflector breeding approach. The powers and Pu production obtained in blankets of different critical assemblies are given. The results obtained led to a correction of the reference calculation of the powers, blanket hot points, and the external regeneration breeding of nuclear power plants. A preliminary analysis is made of the γ heating in blankets. The reference system of equations is improved on the basis of experimental-calculation disagreements. (JSR)

11264 (GEAP-13825-14) INSTRUMENTATION DEVELOPMENT FOURTEENTH QUARTERLY REPORT, APRIL--JUNE 1975. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Jul 1975. Contract AT(04-3)-893. 32p. AT.

The development of instrumentation for surveillance of the core and in-vessel components of liquid metal fast breeder reactors is described. Current development efforts are focused on high temperature neutron detectors and advanced signal transmission methods. This report covers activity during the period April-June 1975. (auth)

11265 (GEAP-14031-4) CORE RESTRAINT ENGINEERING. Fourth Quarterly Report, May-July 1975. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Aug 1975. Contract AT(04-3)-893. 21p. AT.

LMFBR core restraint system design requirements, subcomponents, and analytical methods are discussed. Progress is described for subtasks related to withdrawal force testing, transient analysis, load pad and channel wall lateral limits, in-reactor load pad surveillance, and withdrawal force minimizer. (auth)

11266 (KFK-2216) CONTRIBUTION TO THE ANALYSIS OF THE THERMAL BEHAVIOR OF FAST BREEDER FUEL RODS WITH UO_2-PuO_2 FUEL. Elbel, H.; Jimenez, J. L. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Oct 1975. 97p. (In German). Dep. NTIS (US Sales Only) $5.00.

The fuel of Fast Breeder Reactors which consists of Uranium and Plutonium dioxide is mainly characterized by the amount and distribution of void volume and Plutonium and the amount of oxygen. Irradiation experiments carried out with this fuel have shown that the initial structure of the fuel pellet is subjected to large changes during operation. These are consequences of the radial and axial temperature gradients within the fuel rod. In several parametric studies undertaken with the computer code system SATURN the influence on the thermal behavior of a fuel pin has been analyzed which is caused by restructuring processes such as pore migration and oxygen and Plutonium redistribution due to the radial temperature gradient. The formation of a central hole as a result of pore migration as well as the oxygen redistribution in hypostoichiometric fuel lead to a decrease in the temperature profile. Rise of the Plutonium concentration in the inner zone of the fuel pellet counterbalances this trend. The influence has been shown which the restructuring processes and the thermal qualities of the fuel e.g. heat conductivity and thermal expansion exert due to their dependency on the amount of oxygen. (auth)

11267 (ORNL-5094) FEASIBILITY STUDIES FOR NONDESTRUCTIVE TESTING OF DUPLEX TUBE-TO-TUBESHEET JOINTS AND TUBES FOR AN LMFBR STEAM GENERATOR. Foster, B. E.; Cook, K. V.; Dodd, C. V.; Simpson, W. A. Jr.; McClung, R. W. (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 37p. AT.

Studies were conducted for the development of nondestructive testing techniques for LMFBR steam generators in support of a design concept using duplex tubing. A radiographic technique using ^{192}Ir as the radiation source was developed for the bore-side inspection of duplex tube-to-tubesheet weld joints. Bore-side ultrasonic inspections of the inner member of the duplex tube may be performed at sensitivities comparable with those required for nuclear grade tubing. Simulated flaws at the duplex interface were easily detectable, indicating that longitudinally oriented simulated flaws smaller than 7 percent of the wall of the inner member can be detected with modified commercial transducers. A thermal technique was studied for detection of extremely small variations in the interface gap in the duplex tubing. An eddy-current technique with magnetic saturation, developed with the aid of mathematical models, was investigated for bore-side inspection of duplex tubing. Pit-type defects as small as 25 percent of the duplex wall were detectable. (auth)

11268 (RT/ING-(75)11) FULL SCALE TESTS AND THERMAL DESIGN CORRELATIONS FOR COILED ONCE-THROUGH STEAM GENERATORS. Campolunghi, F.; Cumo, M.; Ferrari, G.; Palazzi, G. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jun 1975. 25p. Dep. NTIS (US Sales Only) $4.50.

Full scale heat transfer tests have been performed in a coiled once-through steam generating tube (d_{tube} = 0.0155 m, d_{coil} = 0.836 m), with subcooled water at inlet and superheated steam at outlet. Pressure (p) ranges from 80 to 170 bar, specific mass flowrate (G) from 1.000 to 2.500 kg/m^2 sec, surface heat flux (q'')

from 10 to 30 × 10^4 W/m^2. q''/G ratios have been kept almost constant, close to a typical value for LMFBR's steam generators: q''/G ≃ 0.13 KJ/kg. It has been deduced that for q''/G < 0.13 KJ/kg no DNB occurs. Designers may so account for a boiling length extended up to 100% quality. Internal and external side heat transfer coefficients, in the superheated steam region of the coil, may differ up to 100% and more. (auth)

11269 PLANS FOR THE SECOND LMFBR PILOT PLANT: A COMMERCIAL 1,000 MW REACTOR PROTOTYPE. Noyes, R. C.; Vitti, J. A.; Penfield, S. R. Arch. Energiewirtsch.; 29: No. 4, 351-353(Apr 1975). (In German)

The world-wide efforts regarding the construction and operation of sodium-cooled fast breeders are outlined. The achieved successes stimulate the planning of a 1,000 MW prototype. The possibilities of diminishing the plant costs and of improvement regarding operational reliability and economy are discussed. Finally, the planned investigations are specified. (GE)

11270 PREDICTION OF PHYSICS PARAMETERS FOR THE LONG-TIME BEHAVIOR OF FAST REACTORS. Helm, F. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik); Spenke, H. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Koeln (F. R. Germany)). Atomkernenergie; 25: No. 2, 153-157 (1975). (In German)

From KTG-special meeting "long-term behavior"; Stuttgart, F. R. Germany (25 Feb 1975). 1 tab.; 12 refs.

The prediction of the burnup reactivity, changes in power distribution, breeding rate, changes in sodium void and Doppler coefficients, burnup of control rods, and formation of higher isotopes is discussed. The existing inaccuracies are described and their economic consequences are investigated. A survey is given of the physical roots of the inaccuracies and of integral experiments which may lead to an improvement of the predictions. Identified as important aims for future work are an improved determination of ^{239}Pu-alpha, ^{238}U-capture rate and delayed neutron parameters as well as the measurement of reactivity coefficients in a realistically simulated geometry and burnup situation. (auth)

11271 COST DETERMINATION FOR COMMERCIAL BREEDER REACTORS. Palmer, R. S.; Horst, K. M. Arch. Energiewirtsch.; 29: No. 4, 353-354(Apr 1975). (In German)

The economic advantages of the fuel cycle of liquid-metal-cooled fast breeder reactors are assessed and predictions are made on the basis of the investments for light-water reactors. The predicted investment costs are 150-250 dollars per kW(e) for commercial reactors which will be ordered in the early eighties and started up about 1990. (GE)

11272 ACCELERATION OF THE COMMERCIAL LMFBR REACTOR. Balent, R.; Lorenzini, P. G. (Atomics International Div., Canoga Park, Calif. (USA). North American Rockwell). Arch. Energiewirtsch.; 29: No. 4, 349-351(Apr 1975). (In German)

The problems with fissionable material, suitability of the Na components and auxiliary systems for large plants, and safety have yet to be solved for the commercial setting-up of LMFBR plants. The fundamental objections to fast breeders are outlined and refuted. The building of larger plants such as SPERT and LOFT is recommended in order to investigate hypothetical accidents in the reactor core. (GE)

11273 USE OF THE AMPLITUDE DISTRIBUTION FUNCTION OF TEMPERATURE NOISE FOR MALFUNCTION DETECTION IN A SIMULATED REACTOR SUBASSEMBLY. Ohlmer, E.; Schwalm, D. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). Atomkernenergie; 25: No. 4, 281-284(1975).

8 figs.; 4 refs.

Using a simple test section simulating a reactor subassembly containing a thermohydraulic anomaly (e.g. a partial blockage), temperature noise measurements have been performed in order to check if it is possible to detect and identify subassembly malfunctions. As a result of these measurements and the analysis of the amplitude distribution function, it followed that it might in principle be possible to develop an early failure detection technique on the basis of temperature noise measurements downstream from the bundle exit. (auth)

11274 LIQUID-LEVEL SENSING DEVICE. Goldfuss, G. T. (to U. S. Energy Research and Development Administration). US Patent 3,905,243. G01F23/22; H01L35/00. 16 Sep 1975. Filed date 11 Sep 1973. 10p.

PAT-APPL-396,339.

This invention relates to a device for sensing the level of a liquid while preventing the deposition and accumulation of materials on the exterior surfaces thereof. Two dissimilar metal wires are enclosed within an electrical insulating material, the wires being joined together at one end to form a thermocouple junction outside the insulating material. Heating means is disposed within the electrical insulating material and maintains the device at a temperature substantially greater than that of the environment surrounding the device, the heating means being electrically insulated from the two dissimilar thermocouple wires. In addition, a metal sheath surrounds and contacts both the electrical insulating material and the thermocouple junction. Electrical connections are provided for connecting the heating means with a power source and for connecting the thermocouple wires with a device for sensing the electrical potential across the thermocouple junction. (auth)

11275 RADIAL BLANKET ASSEMBLY ORIFICING ARRANGEMENT. Patterson, J. F. (to U. S. Energy Research and Development Administration). US Patent 3,892,625. G21C15/04. 1 Jul 1975. Filed Date 12 Oct 1973. 8p.

PAT-APPL-406,519.

A nuclear reactor core for a liquid metal cooled fast breeder reactor is described in which means are provided for increasing the coolant flow through the reactor fuel assemblies as the reactor ages by varying the coolant flow rate with the changing coolant requirements during the core operating lifetime. (auth)

11276 MEASUREMENT OF THE DIFFERENTIAL PRESSURE OF LIQUID METALS. Metz, H. J. (to U. S. Energy Research and Development Administration). US Patent 3,902,369. G01L9/00. 2 Sep 1975. Filed Date 2 May 1974. 4p.

PAT-APPL-466,347.

This patent relates to an improved means for measuring the differential pressure between any two points in a process liquid metal coolant loop, wherein the flow of liquid metal in a pipe is opposed by a permanent magnet liquid metal pump until there is almost zero flow shown by a magnetic type flowmeter. The pressure producing the liquid metal flow is inferred from the rate of rotation of the permanent magnet pump. In an alternate embodiment, a differential pressure transducer is coupled to a process pipeline by means of high-temperature bellows or diaphragm seals, and a permanent magnet liquid metal pump in the high-pressure transmission line to the pressure transducer can be utilized either for calibration of the transducer or for determining the process differential pressure as a function of the magnet pump speed. (auth)

11277 LIQUID LEVEL CONTROLLER. Mangus, J. D.; Redding, A. H. (to U. S. Energy Research and Development Administration). US Patent 3,894,554. F28d7/06. 15 Jul 1975. Filed date 10 May 1972. 8p.

A system for maintaining two distinct sodium levels within the shell of a heat exchanger having a plurality of J-shaped modular tube bundles each enclosed in a separate shell which extends from a common base portion. A lower liquid level is maintained in the base portion and an upper liquid level is maintained in the shell enwrapping the long stem of the J-shaped tube bundles by utilizing standpipes with a notch at the lower end which decreases in open area the distance from the end of the stand pipe increases and a supply of inert gas fed at a constant rate to produce liquid levels, which will remain generally constant as the flow of liquid through the vessel varies. (auth)

Research, Test, and Experimental Reactors

Refer also to abstracts 11207, 11250, 11344, 11359, 11387, and 11390.

11278 (AECL-5124, pp 273-278) DETECTION OF CAN RUPTURES ON FUEL ELEMENTS COOLED BY LIGHT OR HEAVY WATER. Graftieaux, J.; Donguy, R.; Douet, P.; Le Meur, R.; Rouvier, P. (Services D'Electronique de Saclay, France). Jun 1975. (In French)

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Shown are fission products detection devices for the "Reacteur à Haut Flux" (R. H. F.) in Grenoble (heavy water reactor) and for a fuel test loop IRENE in OSIRIS (pressurized light water loop). Results are given on a fission products study on GERMAINE loop in OSIRIS (air loop). R.H.F. burst can detection includes two devices measuring delayed neutrons (D.N.D.). One is used to detect fuel melting, the other to observe can defects. A third device measures ionized fission product activity in the nitrogen

blanket. Its purpose is to detect can cracks. IRENE loop burst can detection includes a D.N.D. and a scintillation counter measuring water gamma activity. Some complementary inquiries are given by germanium-lithium detectors. GERMAINE loop is used for spectrometer calibration and for study of gaseous fission product transport, but this study has also shown transport of solid fission products without gaseous precursors. The spectra from the two loops are processed on a MULTI-8 computer, which allows peak characteristics to be determined (energy, full width at half maximum, area). This computer is also used to control spectrometers. Thus gamma spectrometry with semiconductor detectors is very useful and complementary for fission product detection. (auth)

11279 (HEDL-TME-75-98) SODIUM FIRE PROTECTION BY SPACE ISOLATION, OPEN CATCH PAN AND NITROGEN FLOODING: FFTF PROOF TEST F5. Boehmer, W. D.; Hilliard, R. K. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Oct 1975. Contract AT(45-1)-2170. 90p. AT.

A large-scale sodium fire extinguishment test was performed to demonstrate the adequacy of the FFTF secondary sodium fire protection system. Twenty-three hundred pounds of sodium at 1100°F were spilled into an air filled cell which had a steel catch pan protecting the concrete floor and walls. The fire was self-extinguished when the oxygen in the relatively leak tight cell was consumed by sodium-oxygen reaction. Nitrogen flooding was started after 15 minutes to maintain an inert atmosphere during cooling. Only 5.7 percent of the sodium was reacted during the test. Approximately 100 lb. of water were released from the concrete, one tenth of which reacted to form hydrogen. It was concluded that all aspects of the test results were predictable and that the FFTF secondary sodium fire protection system was verified. (auth)

11280 (KFK-2156) ACOUSTIC MEASUREMENTS AT KNK-I REACTOR. Rohrbacher, H. A.; Aberle, J. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Reaktorentwicklung). Sep 1975. 39p. (In German). Dep. NTIS (US Sales Only) $4.00.

The acoustic background of the KNK reactor was measured over a two year period in order to examine the possibilities of applying sound analytical measuring techniques in boiling detection. The noise spectra obtained within the reactor plenum were evaluated under different operating conditions. It was shown that the reactor plenum is sufficiently decoupled from acoustic noise sources outside the vessel, which opens up good prospects for reliably recording boiling noises occurring in the core zone using direct sensors placed in the sodium plenum, and for evaluating them in an integral early acoustic warning system. The resonance noises of the secondary sodium pumps were used in the determination of the transfer function of sound conducted by solids and compared with the response of in-pile sensors. It was found that the KNK reactor shows a clear acoustic longterm behavior characterized by a continually rising integral acoustic intensity for which a relation could neither be found to reactor power nor to the coolant temperature. (auth)

11281 (ORNL-TM-5111) OAK RIDGE RESEARCH REACTOR QUARTERLY REPORT APRIL, MAY, AND JUNE OF 1975. Hurt, S. S. III; Lance, E. D. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 37p. Dep. NTIS $4.00.

The ORR operated at an average power level of 29.8 MW for 85.5 percent of the time during April, May, and June of 1975. Twelve fuel elements were declared spent (53.3 percent average burnup) during the quarter, while seventeen new elements were placed in service. Four shim-rod elements were retired from service at an average burnup of 64.6 percent. The reactor was shutdown on thirteen occasions, three of which were unscheduled. Two end-of-cycle shutdowns accounted for 79.1 percent of the total downtime. The remaining downtime was used principally for refueling, experimental work, and maintenance. Maintenance activities, both mechanical and instrument, were essentially routine in nature. Special tests or measurements completed during the quarter included flux mapping for core Nos. 125A and 126A. (auth)

11282 (ORNL-TM-5169) HIGH FLUX ISOTOPE REACTOR QUARTERLY REPORT APRIL, MAY, AND JUNE OF 1975. McCord, R. V.; Corbett, B. L. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 19p. Dep. NTIS $4.00.

The replacement of the permanent beryllium reflector was started this quarter. A reexamination of the cracks in this assembly, conducted one fuel cycle before the replacement started, disclosed new cracks or extensions of old cracks on both the inside and outside surfaces. Despite the damage it had sustained, the cracked beryllium was removed in one piece by the end of the quarter. After the reactor was shut down, a test of journal-type bearings on one control plate indicated that this bearing has the potential to replace the troublesome ball bearings. (auth)

11283 (RCN-232) NEUTRON SPECTRA IN THE STEK FACILITY, DETERMINED WITH THE SAND-II ACTIVATION TECHNIQUE. Zijp, W. L.; Nolthenius, H. J.; Baard, J. H. (Stichting Reactor Centrum Nederland, Petten). Sep 1975. 30p. Dep. NTIS (US Sales Only) $5.00.

The coupled fast-thermal critical facility STEK, designed for reactivity worth measurements of fission product samples, has been operated with five standard cores with different central neutron spectra. For three standard cores the neutron spectrum in the central oscillator element was also determined with a series of activation and fission foils, using the SAND-II program for spectrum unfolding. Results of the neutron spectrum determinations are presented in the ABBN group structure, together with the results of a Monte Carlo error analysis considering the effects of variations in the input spectrum, of measurement errors in the input activities, and of uncertainties in the cross section data. (auth)

11284 ULTRAFAST TRANSPORTATION SYSTEM FOR PULSED RADIATION SOURCES. Kreiner, H. J. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Forschungsreaktor). Atomkernenergie; 25: No. 3, 227-229(1975). (In German)

From 3rd European conference on Triga-Users; Neuherberg/Muenchen, F. R. Germany (29 Oct 1974). 7 figs.; 1 tab.; 6 refs.

For investigations of shortlived nuclides an ultrafast transportation system has been developed and installed at the TRIGA Mark III-Reactor of the GSF, Munich. The system is working automatically and is synchronized with the reactor pulse. The time between the end of neutron irradiation and the start of the measurement is less than 45 ms. Another specific characteristic of the equipment is the automatic separation of sample and transfer-capsule and the stability of transfer time (≤ ±1%). First measurements with shortlived nuclides have proved the reliability of the system. Nuclides like ^{207m}Pb, ^{38m}Cl and ^{24m}Na besides fission products could be identified. (auth)

11285 CONFERENCE ON RESEARCH, TEST AND TRAINING REACTORS. Transactions of the American Nuclear Society Conference Held at Charlottesville, Virginia, August 12-14, 1974. Charlottesville, VA; University of Virginia (1974). 99p. (CONF-740841).

Thirty-five summaries are presented on: operating experience with research reactors, experimental techniques and facilities, standards for research reactors, and utilization of research and training reactors. Each summary is title listed separately in NSA. (DLC)

For titles of individual papers see: 8838, 8839, 9370, 9511, 9804, 10955, 11207, 11286-11311, 11359, and 11390.

11286 FUTURE OF RESEARCH REACTORS. Whittemore, W. L. (General Atomic Co., San Diego, CA). pp 2-3 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).

From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11287 TRIGA REACTOR PERTURBATION STUDIES. Easly, J. A.; Levine, S. H. (Pennsylvania State Univ., University Park). pp 5-6 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).

From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11288 INVESTIGATION INTO THE CAUSES OF POWER FLUCTUATIONS IN FLIP FUELED REACTORS. Randall, J. D.; Gradle, R. J.; Wood, G. C. (Texas A and M Univ., College Station). pp 7-10 Conference on Research, Test, and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).

From conference on research, test, and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11289 OPERATIONAL EXPERIENCE AT THE AFRRI-TRIGA REACTOR FACILITY (1972-1974). McKenzie, J. L. (Armed Forces Radiobiology Research Inst., Bethesda, MD). pp 11-13 of Conference on Research, Test, and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).

From conference on research, test, and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11290 DYNAMIC OPERATION OF UNIVERSITY OF TOKYO REACTOR YAYOI. Wakabayashi, H.; Furuhashi, A.; An, S.; Tamura, T. (Tokyo Univ.). pp 14-15 of Conference on Research,

Test, and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test, and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11291 ATTEMPT TO REDUCE FUEL COSTS AND IMPROVE OPERATING CHARACTERISTICS USING POISONED TRIGA FUEL. Randall, J. D.; Feltz, D. E. (Texas A and M Univ., College Station). pp 16-17 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11292 EVOLUTION OF A CAPTURE GAMMA-RAY BEAM FACILITY. Johnson, W. R. (Univ. of Virginia, Charlottesville). pp 19-20 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11293 MODIFIED ARGONAUT CORE DESIGN. Woodruff, G. L. (Univ. of Washington, Seattle). pp 21-22 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virgina (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11294 UTILIZATION OF THE ADVANCED REACTIVITY MEASUREMENT FACILITIES. Stepan, I. E.; Suckling, D. H.; Simpson, F. B. (Aerojet Nuclear Co., Idaho Falls, ID). pp 23-25 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11295 OPERATION AND THE UTILIZATION OF THE RESEARCH REACTORS AT THE RESEARCH CENTER GEESTHACHT, GERMANY. Krull, W.; Roebert, G. (Gesellschaft fuer Kernenergieverwertung, Geesthacht, Ger.). pp 26-27 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11296 AXIAL FLUX TAILORING METHODS IN TEST REACTORS. Brasier, J. E. (Aerojet Nuclear Co., Idaho Falls, ID). pp 31-32 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11297 SMOOTHLY FLOWING DEVELOPMENT OF A STANDARD FROM SCISSORS DRAFT TO ANSL ADOPTION: LOGISTICS OF STANDARDS DEVELOPMENT AND APPROVAL. Whittemore, W. L. (General Atomic Co., San Diego, CA). pp 35-36 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11298 AIR MONITORING EXPERIENCE AT THE BATTELLE RESEARCH REACTOR. Kok, K. D. (Columbus Labs., OH). pp 37-38 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11299 STANDARDS AT THE NBS REACTOR. Carter, R. S. (National Bureau of Standards, Washington, DC). pp 39-40 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test, and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11300 DEVELOPMENTS IN RESEARCH REACTOR UTILIZATION FOR NEUTRON RADIOGRAPHY. Barton, J. P. (Oregon State Univ., Corvallis). pp 42-43 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11301 REACTOR SECURITY SYSTEM. Elliott, A.; Edwards, D. R. (Univ. of Missouri, Rolla). pp 48-49 of Conference on Research, Test and Training Reactors. Charlottesville, VA: Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11302 EXPERIENCE WITH THE USAEC REACTOR SHARING PROGRAM. Kirkland, R. S. (Georgia Inst. of Tech., Atlanta); Walker, D. M.; Muranaka, R. G. pp 59-60 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11303 RADIOACTIVE IODINE EVOLVED INTO REACTOR COOLING WATER TO LOCATE DEFECTIVE FUEL ELEMENTS. Stroud, C. M.; Edwards, D. R. pp 61-62 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11304 BERYLLIUM DAMAGE AT THE HIGH FLUX ISOTOPE REACTOR. Corbett, B. L. (Oak Ridge National Lab., TN). pp 68-69 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11305 DECOMMISSIONING OF THE AIR FORCE NUCLEAR ENGINEERING CENTER (1970-1971). McKenzie, J. L.; Wilson, B. A. (Armed Forces Radiobiology Research Inst., Bethesda, MD). pp 72-76 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11306 NON-CONTACT IRRADIATED FUEL-PLATE TEMPERATURE MEASUREMENTS AT THE NBSR. Frizzell, O. E.; Darr, J. H.; Raby, T. M. (National Bureau of Standards, Washington, DC). pp 79-80 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11307 V.P.I. AND S.U. REACTOR PROGRAM IN NUCLEAR ACTIVATION ANALYSIS. Furr, A. K. (Virginia Polytechnic Inst. and State Univ., Blacksburg). pp 82-83 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11308 DESCRIPTION OF PNEUMATIC FACILITIES AT THE NBSR. Bickford, N. A.; Raby, T. M. (National Bureau of Standards, Washington, DC). pp 88-89 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11309 CONVERSION OF A PNEUMATIC TRANSFER SYSTEM TO CLOSED LOOP OPERATION. McMaster, I. B. (Pennsylvania State Univ., University Park). pp 90-91 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11310 NEUTRON ACTIVATION ANALYSIS: EVALUATION AND CHARACTERIZATION OF THE NBSR IRRADIATION FACILITIES. Becker, D. A.; LaFleur, P. D. (National Bureau of Standards, Washington, DC). pp 92-94 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

11311 DAMAGE RESEARCH FACILITIES IN THE ORNL BULK SHIELDING REACTOR. Coltman, R. E. Jr. (Oak Ridge National Lab., TN). pp 95-96 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

Production and Materials Testing and Processing Reactors

Refer also to abstracts 11289, 11304, and 11341.

11312 IRRADIATIONS BY MEANS OF REACTOR PULSES. Menke, H.; Trautmann, N.; Krebs, W. J. (Mainz Univ. (F. R. Germany). Inst. fuer Kernchemie). Kerntechnik; 17: No. 6, 281-286(Jun 1975). (In German, English).

3 figs.; 2 tabs.; 7 refs.

It is shown by a simple calculation that the advantage of pulse irradiation over steady state irradiation depends on the half-life of the nuclide produced and on the neutron fluence of the pulse. The time-course of reactor pulses induced by various reactivity insertions was measured in order to optimize the control of the irradiation and measurement program by means of an electronic programmer or by photocells responding to the Cherenkov flash accompanying the pulse. The peak power, the time to peak power, the total energy release and the half-width of the pulses were calculated and were compared to measured experimental data. The pneumatic transfer systems of the reactor are briefly mentioned and one conventional system, which was modified for pulsed irradiation experiments, is described in more detail. (auth)

Propulsion and Package Reactors

Refer also to abstract 9769.

11313 (N-75-13093) PUMPED LITHIUM LOOP TEST TO EVALUATE ADVANCED REFRACTORY METAL ALLOYS AND SIMULATED NUCLEAR FUEL ELEMENTS. Brandenburf, G. P.; Hoffman, E. E.; Smith, J. P. (General Electric Co., Cincinnati, Ohio (USA)). Jan 1974. Contract NAS3-6474. 106p. (NASA-CR-134527). NTIS $5.25.

The performance was determined of refractory metal alloys and uranium nitride fuel element specimens in flowing 1900^{0}F (1083^{0}C) lithium. The results demonstrate the suitability of the selected materials to perform satisfactorily from a chemical compatibility standpoint. (auth)

11314 (RN-DR-0092(Rev. A)) CHARTER EXPERIMENTAL ENGINE PERFORMANCE EVALUATION TEAMS. (Aerojet-General Corp., Sacramento, Calif. (USA)). Dec 1966. 7p. Dep. NTIS $4.00.

To provide for prompt and effective evaluation of the performance of the Experimental Engine during its operation in ETS-1 and of the condition of the test article and the facility during and following its operation the following Experimental Engine Performance Evaluation Teams were created: (1) Test Diagnostic Team (TDT), (2) Test Information Limits Team (TILT), and (3) System Performance Evaluation, Analysis and Review Team (SPEAR). The purpose, function and responsibilities of each of these groups are described. (auth)

11315 (RN-DR-0150A (Bk. 3)) ENGINE TEST STAND-1 FACILITY MODIFICATIONS FOR 75K NERVA. RN-DR-0150 Basic Formating Sample. Project 223. (Aerojet-General Corp., Sacramento, Calif. (USA)). 15 Jan 1970. 19p. Dep. NTIS $4.00.

Each modification or modification study is to be entered within its subsystem section. Each entry in the subsystem section will be laid out in the same format and contain the information necessary to extract the entry for further processing for modification without rewrite. Also included are: (1) a subsystem-activation sequence guide; (2) a subsystem cross-reference guide; (3) subsystem impact analysis sheets; and (4) modification work sequence guide for charting purposes. It is intended that each ETS-1 modification package contain under one cover all the data necessary to complete the modifications (such as Mechanical, Electrical, Instrumentation, and Controls). Each modification will contain a subsystem-impact analysis chart to identify the subsystems affected. An example of a proposed modification is given as a format of how modifications to be considered for proposal are to be prepared. This format will be compatible with PD 1069, so that the Change Proposal (Form NTO-06-003) can be attached without a rewrite of the backup data. (auth)

11316 (RN-S-0400(Rev. B)) XE TEST SPECIFICATION. Revision B. (Aerojet-General Corp., Sacramento, Calif. (USA)). 15 Jan 1969. 115p. Dep. NTIS $8.75.

Revised detailed specifications and related information required for the performance of the XE test program in Engine Test Stand No. 1 (ETS-1) are described. (LTN)

11317 (RN-S-0400(Rev. D)) XE TEST SPECIFICATION. Revision D. (Aerojet-General Corp., Sacramento, Calif. (USA)). 23 Dec 1969. 72p. Dep. NTIS $6.75.

11318 (TID/SNA-93) COMPARISON OF NUCLEAR AND CHEMICAL ROCKETS. (Aerojet-General Corp., Sacramento, Calif. (USA)). 9 Sep 1958. 1p. Dep. NTIS $4.00.

Declassified 16 Oct 1968.

11319 (TID/SNA-236) PERFORMANCE/DESIGN AND QUALIFICATION REQUIREMENTS FOR SHIELD SPACER. (Aerojet-General Corp., Sacramento, Calif. (USA)). 15 Dec 1969. 8p. Dep. NTIS $4.00.

11320 (TID/SNA-288) NERVA CONFIGURATION MANAGEMENT PLAN, C-018. (Aerojet Nuclear Systems Co., Sacramento, Calif. (USA)). Aug 1971. 45p. Dep. NTIS $5.25.

This plan establishes the philosophy for configuration identification, control, and accounting for the NERVA engine system, the nuclear subsystem and the engineering critical components (ECC). NERVA engine system requirements are initially defined in the SNPO-prepared NERVA program requirements document (SNPO-NPRD-1) and subsequently in Part I of the specifications. The Part I contract end item (CEI) specifications delineate the performance and design requirements which establish the criteria for the development of the detailed design documents. The basic principle of managing requirements and design documentation is the control of changes to approved baselines and the proper invocation of all applicable documents, of a specific issue, to define a particular configuration. This will be accomplished by first listing the performance/design requirements documents and then defining the configuration to meet these requirements by identification of design documents on a parts-list document. This document will then define a starting point for a particular configuration or design-requirement objective. This starting point marks a significant milestone objective that has been pre-planned and is commonly called a "baseline." Baselines are then the formal points of departure for control of future changes. This plan encompasses three objectives: (1) configuration identification, which is the positive identification of the specific design documents describing design requirements; (2) configuration control, which is the preparation and control of proposed changes to the established requirements or configuration and the implementation of the changes when approved; and (3) configuration accounting, which is the recording of the actual configuration of deliverable equipment. Configuration management may then be said to be the management of technical requirements, the design solutions to those requirements, and the changes thereto. It is implemented through formalized procedures which inject an orderly and systematic approach to support the identification, control, and accounting objectives of configuration management. (auth)

11321 (WANL-TME-997(Suppl.1)) REACTOR EXPERIMENTATION AND THE PACKARD-BELL COMPUTER. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1966. 31p. Dep. NTIS $4.75.

Some reactor calculations which can be done on the Raytheon computer (formerly known as the Packard-Bell 250 computer) are described. (LTN)

11322 (WANL-TME-1633(Suppl.1)) NRX-A6 SAFETY EVALUATION REPORT. Meyer, L. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Nov 1967. 10p. Dep. NTIS $4.00.

Results of analyses performed to resolve outstanding problems are presented, along with additional information considered pertinent to the safety of the NRX-A6 test. (LTN)

11323 (WANL-TME-1634) NRX-A6 OPERATING LIMITS DOCUMENT. Hemmerle, E. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1967. 13p. Dep. NTIS $4.00.

The constraints are defined within which NRX-A6 reactor operations prior to initial criticality will be accomplished at the Nuclear Rocket Development Station, NRDS. These operations include Receiving and Inspection of the Reactor, Assembly of the Test Article, Peripheral Poison Removal, Central Poison Wire Removal which will be carried out in the E-MAD Building, transport to Test Cell "C" and mate-up and checkout of the Test Article prior to initial criticality. The operating limits contained herein specify the administrative and technical boundaries within which these reactor operations will be performed. Management Controls define the administrative limits including the required documentation and the documentation approval mechanism. Operational Controls define the boundaries, procedural safeguards and operating safety limits, within which NRX-A6 operations will be completed. Only those sections of documents applicable to operations prior to initial criticality and specifically referenced are incorporated as operating limits. (auth)

Reactor Safety and Environmental Aspects

Refer also to abstracts 9268, 9422, 9774, and 9951.

11324 (ANS-SD-15) PROCEEDINGS OF THE SPECIAL SESSION ON PLANT AND EQUIPMENT DESIGN FEATURES FOR RADIATION PROTECTION, NEW ORLEANS, LOUISIANA, JUNE 8--13, 1975. (American Nuclear Society, Oak Ridge, Tenn.). Nov 1975. 78p. (CONF-750661-1). Dep. NTIS $5.45.

From special session of the ANS on plant and equipment and design features for radiation protection; New Orleans, Louisiana, USA (8 Jun 1975).

Six papers are included on design and operating procedures to assure protection of nuclear power plant personnel from excessive radiation doses. A separate abstract was prepared for each paper. (HDR)

For abstracts of individual papers see: 11325–11330.

11325 (ANS-SD-15, pp 1-20) SHIELDING DESIGN FOR BETTER PLANT AVAILABILITY. Biro, G. G. (Gibbs and Hill, Inc., New York). November 1975.

From special session of the ANS on plant and equipment and design features for radiation protection; New Orleans, Louisiana, USA (8 Jun 1975).

In proceedings of the special session on plant and equipment design features for radiation protection, New Orleans, Louisiana, June 8-13, 1975. (American Nuclear Society, Oak Ridge, Tenn.).

Design methods are described for providing a shield system for nuclear power plants that will facilitate maintenance and inspection, increase overall plant availability, and ensure that man-rem exposures are as low as practicable. (HDR)

11326 (ANS-SD-15, pp 21-26) DESIGN FEATURES TO REDUCE OCCUPATIONAL EXPOSURE. Adam, J. A.; DiSabatino, A. A. Jr.; Vanasse, R. E. (Stone and Webster Engineering Corp., Boston). Nov 1975.

From special session of the ANS on plant and equipment and design features for radiation protection; New Orleans, Louisiana, USA (8 Jun 1975).

In proceedings of the special session on plant and equipment design features for radiation protection, New Orleans, Louisiana, June 8–13, 1975. (American Nuclear Society, Oak Ridge, Tenn.).

Some of the design principles which are important considerations in the evolution of a nuclear power plant design to ensure that occupational radiation exposures can be minimized are discussed. Emphasis is placed on the design features affecting the basic layout and equipment locations within the plant. Examples are provided showing how these design objectives are realized in the Stone and Webster Reference Nuclear Power Plant Design, with particular emphasis on the Annulus Building portion of the reference plant. Design features which are useful in reducing occupational exposure during normal operation are discussed initially, followed by those that chiefly affect exposures during maintenance activity. Finally, those provisions in the design which assist in preventing the spread of radioactive contamination are presented. (auth)

11327 (ANS-SD-15, pp 27-34) ARCHITECT ENGINEER BALANCE-OF-PLANT RADIOLOGICAL DESIGN CONSIDERATIONS. Piccot, A. R. (Sargent and Lundy Engineers, Chicago). Nov 1975.

From special session of the ANS on plant and equipment and design features for radiation protection; New Orleans, Louisiana, USA (8 Jun 1975).

In proceedings of the special session on plant and equipment design features for radiation protection, New Orleans, Louisiana, June 8–13, 1975. (American Nuclear Society, Oak Ridge, Tenn.).

Methods which are or may be used by Architect Engineers in dealing with the problems of radiological safety in the design of a nuclear power plant are discussed. The bases and basic requirements for a radiation protection program are briefly noted. Requirements in the areas of planning, organization, responsibilities and implementation of radiation protection are discussed. Lists of safety tasks which should be performed during the various design phases are presented. (auth)

11328 (ANS-SD-15, pp 35-47) CONTROL OF OCCUPATIONAL RADIATION EXPOSURES IN TVA NUCLEAR POWER PLANTS DESIGN AND OPERATING PHILOSOPHY. Stone, G. F.; Beasley, E. G. Jr.; Zobel, W.; Belvin, E. A. Jr.; Lyon, M. (Tennessee Valley Authority, Chattanooga). Nov 1975.

From special session of the ANS on plant and equipment and design features for radiation protection; New Orleans, Louisiana, USA (8 Jun 1975).

In proceedings of the special session on plant and equipment design features for radiation protection, New Orleans, Louisiana, June 8–13, 1975. (American Nuclear Society, Oak Ridge, Tenn.).

Because of the Tennessee Valley Authority commitment to nuclear power, a formal program has been initiated for keeping in-plant personnel radiation exposures as low as practicable (ALAP). The design and operating philosophy relative to implant radiation control at the Browns Ferry plant is described, and the plans for implementation of ALAP criteria in future plants are discussed. (HDR)

11329 (ANS-SD-15, pp 49-70) MINIMIZING RADIATION EXPOSURES IN PWR PLANTS. Clemons, L. Jr. (Westinghouse Electric Corp., Monroeville, PA); Battaglia, J. A. Nov 1975.

From special session of the ANS on plant and equipment and design features for radiation protection; New Orleans, Louisiana, USA (8 Jun 1975).

In proceedings of the special session on plant and equipment design features for radiation protection, New Orleans, Louisiana, June 8–13, 1975. (American Nuclear Society, Oak Ridge, Tenn.).

Control of implant personnel radiation exposures at nuclear power plants has been accomplished through administrative control and maintenance procedures in operating plants and in the design and layout of new plants. Experience gained at operating pressurized water reactors is reviewed to illustrate how the guidelines for as low as practicable exposure are addressed. (HDR)

11330 (ANS-SD-15, pp 71-74) LABYRINTH DESIGN IN NUCLEAR POWER PLANTS. Kaiseruddin, M. (Sargent and Lundy Engineers, Chicago). Nov 1975.

From special session of the ANS on plant and equipment and design features for radiation protection; New Orleans, Louisiana, USA (8 Jun 1975).

In proceedings of the special session on plant and equipment design features for radiation protection, New Orleans, Louisiana, June 8–13, 1975. (American Nuclear Society, Oak Ridge, Tenn.).

Labyrinth entrances to shielded rooms are extensively employed in nuclear power plants as they provide economical and convenient radiation protection for the outside areas. A most commonly used simple labyrinth arrangement was analyzed with radiation source energy and strength (indirectly) as parameters. Design curves were developed for the simple labyrinth. It was determined that such simple labyrinths are adequate for high energy gamma ray sources, but may not be so for many of the low energy sources. (auth)

11331 (CEE-5-1973-74) RADIOACTIVE EFFLUENTS FROM NUCLEAR POWER STATIONS IN THE COMMUNITY. Discharge Data. Radiological Aspects. (Commission of the European Communities, Luxembourg). Apr 1974. 19p. (In French). INIS.

23 tabs; 24 refs. Also published in English.

The values of the activities released in gaseous or liquid form by the nuclear power plants of the Community and by those operated by the Central Electricity Generating Board of Great Britain are compiled for 1969, 1970, 1971, and 1972. The radionuclide composition of the rare gases released by the different power plants are also given. For the liquid effluents, in addition to the radionuclides identified in 1972, the method used for the detection of the activity of the liquid effluent is indicated. The fraction of the maximum permissible concentration for drinking water, in yearly average, is also given. An estimation is made of the maximum exposure around the sites. It is compared to the dose limits fixed by radioprotection standards and to the natural level of radiation. The ratio of the activity released (rare gases, liquid effluents without tritium) to the energy produced is given for each power plant. (tr-INIS)

11332 (CONF-750607-31) VERTICAL SLIP FLOW AND FLOODING MODELS IN LOCA ANALYSIS. Fischer, S. R. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1975. 27p. Dep. NTIS $4.50.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

Vertical slip flow and flooding models have been incorporated in a version of the RELAP4 computer code in order to better model nuclear reactor coolant system phenomena during postulated large and small break loss-of-coolant accidents. Much of the complex hydrodynamic phenomena believed to occur during ECC injection, ECC bypass, liquid penetration into the downcomer, and lower plenum entrainment is multidimensional in nature leading to modeling difficulties when the present nonslip version of RELAP4 is used. Flooding type models in combination with vertical slip flow can be used to improve modeling of ECC bypass and liquid entrainment phenomena during reversed core flow. Applications to the analysis of core flow blockage phenomena also exist. Flooding used in this discussion denotes Wallis countercurrent type flooding phenomena which limits the maximum liquid downflow for a given vapor upflow. Flooding as used here does not refer to the deluge type reflood of a core. (auth)

11333 (COO-2471-5) MODELING OF CLADDING AND FUEL MOTION IN A LOSS OF FLOW SITUATION FOR GCFR SAFETY ANALYSIS. Progress Report 5, July 15, 1975–October 15, 1975. Eggen, D. T. (Northwestern Univ., Evanston, Ill. (USA)). 15 Nov 1975. Contract E(11-1)-2471. 20p. NTIS.

During the last quarter a closed loop was constructed in which to conduct cladding meltdown experiments in an argon atmosphere. Specially designed electric heater elements were fabricated for test in the loop. A method for cladding the electrically heated elements with Pb/Sn was developed and ten (10) elements are ready for testing. Electrical wiring needs to be completed before testing will be conducted. Tests were continued on pouring hot Pb/Sn alloy through alloy tubes of various diameters. A lumped parameter analysis appears to fit data reasonably well and the effect of diameter is verified. Analysis of a melting model indicates reasonable similitude between stainless steel and Pb/Sn alloy for the conditions under study. Work progresses on the stainless steel blanket pouring experiments, grid spacers were received, alumina rods were clad with stainless steel, and the preheat furnace was fabricated. (auth)

11334 (EURFNR-1268) PARDISEKO III: A COMPUTER CODE FOR DETERMINING THE BEHAVIOR OF CONTAINED NUCLEAR AEROSOLS. Jordan, H.; Sack, C. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik). May 1975. 24p. (KFK-2151). Dep. NTIS (US Sales Only) $4.50.

Work performed under United States–Euratom Fast Reactor Exchange Program.

A detailed description of the latest version of the PARDISEKO code, PARDISEKO III, with particular emphasis on the numerical and programming methods employed is presented. (auth)

11335 (GEAP-13923-12) SAFETY ENGINEERING TWELFTH QUARTERLY REPORT, MAY–JULY 1975. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Aug 1975. Contract AT(04-3)-893. 50p. AT.

Progress is reported in the following LMFBR safety engineering areas: fuel and cladding motion studies, evaluation of nonprototypic effects, and accident code development. (DG)

11336 (GEAP-14048) STATUS OF POST-ACCIDENT CORE RETENTION CONCEPTS AND MODELS. Gluekler, E. L. (Comp.). (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Jul 1975. Contract AT(04-3)-893. vp. AT.

A review and evaluation of core retention concepts and related calculation models is presented with the intent to identify potential problem areas and development needs regarding experimental support and calculational model development. Several systems can be considered potentially viable candidates: the crucible, the trays, and the sacrificial bed. Of these concepts, the crucible and sacrificial bed seem to be more suitable than the tray concept for ex-vessel use. The crucible and trays, and also a combination of the two, have advantages over the sacrificial bed as an in-vessel system. Simple concrete barriers or holes underneath the containment may also represent design alternatives, if it can be demonstrated that the radiological consequences are acceptable. Since the post-meltdown conditions have a significant effect on core retention design concepts, the accident scenario, spatial core debris distribution and decay heating rates were studied. Secondary criticality considerations also present an important design aspect. During the melt-through sequence, recriticality could be prevented through proper design measures. In the steady-state configuration reached in the core retainer, recriticality is more easily manageable. Material studies were initially focused on a materials selection for individual core retention concepts. Based on preliminary evaluations, including the velocity of the meltfront, materials compatibility, availability, and fabricability, MgO, TiC, ZrO_2, Al_2O, and graphite emerged as relatively attractive sacrificial bed materials. Crucibles may consist of stainless steel with a protective coating of UO_2 or graphite (or possibly Cu). A molten layer model and sacrificial bed heat transfer code were developed and are described in an appendix. (auth)

11337 (INIS-mf-1749) SAFETY EVALUATION OF THE EMERGENCY ELECTRIC SYSTEM IN THE NUMBER ONE UNIT OF THE LAGUNA VERDE NUCLEAR ELECTRIC PLANT. Soto, C. L. (Guadalajara Univ. (Mexico). Facultad de Ingenieria). 1974. 102p. (In Spanish). INIS.

The safety of the emergency electrical system of the Laguna Verde plant was evaluated on the basis of the criteria of the Regulatory Guides of the USAEC and of the criteria of the Institute of Electrical and Electronic Engineers (IEEE). A description is given of the plant with emphasis on the special safety systems and their electrical systems. The transmission system and the electrical feed system for the plant auxiliaries are described and then the emergency supply system for providing both direct and alternating current is discussed. The design of the emergency electrical systems was subjected to the criteria cited which indicated that the plant has a high degree of safety. As the design of the plant is under development, it will be necessary to see that these criteria are maintained during the stages of design, construction, pre-operational tests, and operation. (tr-INIS)

11338 (ORNL-TM-5144) INGRES: A COMPUTER CODE FOR THE RATE OF AIR INGRESS INTO AN HTGR FOLLOWING A DESIGN-BASIS DEPRESSURIZATION ACCIDENT. Reid, R. L.; Sanders, J. P. (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 32p. Dep. NTIS $5.00.

The computer program INGRES was written to calculate the rate of air ingress into the prestressed concrete reactor vessel after a design-basis depressurization accident in a high-temperature gas-cooled reactor. The model includes the free convection loop that can occur in a cold-leg break, the expansion and contraction air exchange mechanisms, and the conversion of oxygen to carbon monoxide. Results are presented for the 2000-MW(t) Summit Power Station and the 3000-MW(t) Fulton Generating Station and are compared to computational results provided by the General Atomic Company. The results agree reasonably well even though some differences exist in the two models. (auth)

11339 (ORNL-TM-5217) MONTHLY HIGHLIGHTS FOR OFFICE OF NUCLEAR REGULATORY RESEARCH PROGRAMS AT OAK RIDGE NATIONAL LABORATORY, NOVEMBER 1975. Fee, G. G. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 27p. Dep. NTIS $5.00.

Technical highlights and cost/budget data are presented for the following programs: heavy section steel technology, fission product beta and gamma energy release, LOCA release from LWR fuel, multirod burst tests, Nuclear Safety Information Center, PWR blowdown heat transfer-separate effects, zircaloy fuel cladding collapse studies, zirconium metal-water oxidation kinetics, transient release from LMFBR fuel, HTGR safety analysis and research, and design criteria for piping and nozzles. (DG)

11340 (SAND-75-6101) STATUS OF SANDIA LABORATORIES DEBRIS BED STUDIES PROGRAM. Post Accident Heat Removal Information Exchange, November 13–14, 1975. Rivard, J. B. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1975. 17p. (CONF-751140-1). Dep. NTIS $4.50.

From meeting on post-accident heat removal information exchange; Albuquerque, New Mexico, USA (13 Nov 1975).

The current status (November 1975) of the Sandia Laboratories Debris Bed Studies Program is reviewed. The primary objective of the initial experiments is the characterization of the sodium dryout instability in a bed of frozen fuel particulate which might lead to remelting and the associated high temperatures in a Liquid-Metal Fast Breeder Reactor. Progress is delineated in experiment and pre-experiment test planning, safety analysis, helium cooling loop assembly, experiment capsule design, diagnostic and control instrumentation, experiment operating characteristics, and fuel specification. It is concluded that, barring unforeseen delays, the initial experiments should be performed near mid-1976. (auth)

11341 (UNI-SA-14) CHARACTERIZATION OF ARGON-41 PRODUCTION AT N REACTOR HANFORD RESERVATION, WASHINGTON. Cucchiara, A. L. (United Nuclear Industries, Inc., Richland, Wash. (USA)). 1 Dec 1975. 9p. (CONF-760202-16). Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

As a result of normal N Reactor operation, approximately 50,000 curies of ^{41}Ar are released to the atmosphere at Hanford each year. Although the total population whole-body dose of 1.1 man-rem/year due to these ^{41}Ar emissions is very small compared to the total population whole-body dose of 27,000 man-rem/year due to natural background, efforts are being directed towards reducing the ^{41}Ar emissions. Analyses of the potential sources of ^{41}Ar in N Reactor systems have been conducted. At least 70 percent of the total quantity of Ar that is released to the atmosphere is attributable to Ar that is present within the reactor gas system. Sources of Ar that have been investigated include entrance of air within the gas dryers, back diffusion of air through a reactor wall seal, dissolved Ar in the reactor cooling water, Ar blanket on the control rod hydraulic fluid, entrance of air during reactor shutdown periods, and air within the flux monitor detectors. (auth)

11342 (XN-74-27(A)(Rev. 2)) BULGEX: A COMPUTER CODE TO DETERMINE THE DEFORMATION AND THE ONSET OF BULGING OF ZIRCALOY FUEL ROD CLADDING (APPLICABLE FOR LOSS OF COOLANT ACCIDENT CONDITIONS). Merckx, K. R. (Exxon Nuclear Co., Richland, Wash. (USA)). Dec 1974. 159p. Exxon Nuclear Co., Inc., Richland, WA.

A deformational model for zircaloy-cladding under the temperature, stress, and environmental conditions encountered during a LOCA has been incorporated in a time incremental code, BULGEX, which determines the deformation history, internal pressure history, and the onset of clad bulging. The theo-

retical bases for the BULGEX code, methods for interpreting these data, the resultant plastic and creep deformation model and stability criterion, and the results of sensitivity studies on typical BWR geometries are presented. (auth)

11343 RISKS AND UNCERTAINTIES IN THE DESIGN OF NUCLEAR POWER PLANTS. Arch. Energiewirtsch.; 29: No. 6, 619-624(Jul 1975). (In German)

Shortened version from Nucl. Eng. Des.; 31: 396-405(1972).

The optimization of the design of engineering systems such as nuclear power stations is discussed. The effect of unforeseen failures and deviations on the construction and operation of the plant is examined. (GE)

11344 CORRELATION ANALYSIS OF THE ENVIRONMENTAL INFLUENCES ON THE RADIOACTIVE ARGON RELEASES FROM THE PLUME OF THE REACTOR DIORIT. Behringer, K.; Feuermann, D.; Kostic, L.; Seifritz, W. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Atomkernenergie; 26: No. 1, 61-67(1975).

9 figs.; 5 refs.

During a one-month period the influence of meteorological variables (e.g., wind speed, wind direction, vertical temperature gradient) on the gamma dose rate — emitted from the plume of the 25 MW(t) heavy water reactor DIORIT — was studied. Stochastic methods and multiple regression analysis were used. A simple model which consists of a linear superposition of the various effects on the dose rate was assumed. The time records of the dose rate, wind speed, wind direction and vertical temperature gradient show the typical characteristics of a non-ergodic, non-stationary process. Therefore, a corresponding analysis technique had to be applied. Mean values, standard deviations, covariance functions, partial and multiple correlation coefficients were calculated using the ensemble averaging technique. (auth)

11345 UNDERGROUND CONSTRUCTION OF NUCLEAR POWER STATIONS. Merz, L. (Technische Univ. Muenchen (F. R. Germany). Inst. fuer Mess- und Regelungstechnik). Atomwirtsch., Atomtech.; 20: No. 7, 363-366(Jul 1975). (In German)

7 refs.

In the discussions about the safety of nuclear installations the question of building nuclear power stations below ground is being raised again and again. Almost all the experts in the field regard further investigations of underground construction as necessary or desirable. Although in present above-ground plant designs safety measures must ensure that the consequences of hypothetical accidents will in any case be accommodated without involving any hazard to the public, there are some question marks when it comes to ensuring protection against acts of war and sabotage. This contribution outlines the variants of underground designs of nuclear power stations and their feasibility at the present state of the art. The question is studied whether underground construction will increase the safety of the public as against present above-ground designs. Another problem considered is the question of whether the extensive protective measures required under the present licensing procedures and implemented in these plants already preclude any real hazard to the environment with a high degree of certainty, which would leave no necessity for underground constructions. (auth)

11346 GAS-COOLED 300 MW FAST BREEDER REACTOR. Arch. Energiewirtsch.; 29: No. 7, 684-694(Jul 1975). (In German).

4 figs.; 2 tabs.

Following a description of the reactor design, safety problems are discussed with regard to the 5 major fault chains. The last part deals with irradiation tests of the UO_2-PuO_2 fuel rods for the GCFR reactor. (GE)

11347 FEAR CAUSING VENTURE. Spiegel; 29: No. 30, 32-41(Jul 1975). (In German)

With figs.

The FRG program for the construction of nuclear power stations in the next ten years is described and the danger which would ensue if technology were to fail in spite of all the calculations done is discussed. (GE)

11348 FIRE AT BROWNS FERRY STATION. Atomwirtsch., Atomtech.; 20: No. 7/8, II-III(Jul 1975). (In German)

A cable fire broke out at Browns Ferry-1 and -2 power station when sealing material which had been used as a make-shift seal for a cable duct caught fire in the course of a leakage test with an open light. Both blocks of the power station were scrammed manually so that nobody was injured and no activity was released. On the basis of the information supplied by NRC and TVA (the operator), the IRS has attempted a tentative evaluation of the incident. The results are presented in a summarized version. (GE)

11349 POWER PLANT SITES. Kuhlmann, A. (Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (F. R. Germany)). Kerntechnik; 17: No. 7, 307-315(Jul 1975). (In German)

From lecture meeting on energy and environment; Duesseldorf, F. R. Germany (5 Dec 1975). 12 figs.; 2 refs.

To find suitable sites for conventional as well as for nuclear power plants turns out to become more difficult. The examples given show that, as long as well known technologies are used, a sufficient number of sites for conventional power plants can be provided in the future. For nuclear power plants, the situation is different, because in addition to regular operation, the maximum accident must be taken into account, which is not considered in the design in view of its extremely low likelihood. After having discussed the so-called Rasmussen report, the author comes to the conclusion that if the necessary efforts are made, even sites in the vicinity of cities could be acceptable in the Federal Republic of Germany. (auth)

11350 DESIGN OF NUCLEAR POWER PLANTS WITH RESPECT TO SEISMIC EFFECTS. I. Principles. Bundesanzeiger; 27: No. 130, 1-2(Jul 1975). (In German)

A safety regulation by the Kerntechnischer Ausschuss of the FRG of July 4th, 1975 is presented. (GE)

11351 RADIATION BURDEN DUE TO RADIONUCLIDES RELEASED FROM NUCLEAR POWER PLANTS AND REPROCESSING PLANTS. Bonka, H. (Technische Hochschule Aachen (F. R. Germany). Lehrstuhl fuer Reaktortechnik); Vogt, K. J. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralabteilung Strahlenschutz). Radiologe; 15: No. 6, 590-597 (Jun 1975). (In German)

11 figs.; 5 tabs.; 38 refs.

The additional radiation exposure to the population due to radionuclides released from nuclear facilities is at present much lower than the extent of variations of the natural radiation exposure to larger population groups. It will increase in the future, but it will fall within the extent of variations of the natural radiation burden if the first large reprocessing plants will already be equipped with ^{3}H and ^{85}Kr extraction plants for separation efficiencies of about 99%. (GE)

11352 WYHL FROM THE COUNTRY'S POINT OF VIEW. Grawe, J. Umwelt; No. 3, 59-62(Jun 1975). (In German)

2 figs.; 2 tabs.

The Ministry for Economy, Small Business and Traffic responsible for the energy planning of the Federal Land Baden-Wuerttemberg gives reasons for the use of nuclear power plants to supply electricity for the next decades. In addition to the non-harmful effects to the environment of nuclear energy, the lack of fossil fuels is also a decisive factor for the future. In selecting the site Wyhl, agricultural meteorological aspects as well as those of the countryside and nature protection have been considered so that objections by the population based on these reasons have, to a large extent, no foundation. A comparison of risks shows that the hazards due to nuclear power plants are frequently greatly overestimated. (GE)

11353 NUCLEAR POWER PLANT SAFETY CRITERIA. Approved by the Laender Committee for Nuclear Energy. Koeln, F. R. Germany; IRS (25 Jun 1974). 17p.

The nuclear power plant safety criteria have been prepared as the technical part of General Administrative Regulations still to be enacted. The criteria were approved by the Laender Committee for Nuclear Energy on June 25th, 1974 after the groups of experts participating in the licensing procedure, including the manufacturing and constructing industries, utilities and expert consultants, had the opportunity to express their opinions. These safety criteria have been developed especially for application to nuclear power plants with light water reactors; for all other types of nuclear power plants, however, they are strictly applicable for non-facility specific requirements and in principle for facility specific requirements. (GE)

11354 BUERGERINITIATIVEN IM BEREICH VON KERNKRAFTWERKEN. (Citizens' Initiatives in Connection With Nuclear Power Plants). van Buiren, S.; Devivere, B. V.; Dierkes, M.; Galland, H.; Hildebrand, H.; Schmid-Joerg, I.; Schubert, I.; Troeller, G. (Battelle-Institut e.V., Frankfurt am Main (F. R. Germany)). Bonn, F. R. Germany; BMFT (1975). 330p.

16 figs.; 51 tabs.; 63 refs.

The coverage by the press in local and national newspapers of citizens' initiatives in connection with nuclear power plants from 1970 until 1974 is examined. Nationally about 20,000 articles about nuclear energy were published. Only in a small fraction was the approach to this source of energy critical and mentioned citizens' initiatives. The regional press in areas with concentrations of population made a clear statement in favor of nuclear power plants still in the design stage. In rural

areas, however, the attitude was neutral or disapproving. Of all problems the siting question seems to be the central point of interest. (GE)

11355 EMERGENCY COOLING SYSTEM FOR A NUCLEAR REACTOR. Desmarchais, W. E.; Katz, L. R.; Silverblatt, B. L. (to Westinghouse Electric Corp.). German(FRG) Patent 2,432,131/A/. 20 Feb 1975. 25p. (In German)

4 figs.

An emergency cooling system for nuclear reactors is given. It consists of a storage tank under pressure from which the emergency coolant is forced into the reactor core in case of a drop of the reactor coolant pressure caused by, e.g., a pipe rupture in the primary cooling circuit. Due to non-return valves in the supply lines to the reactor pressure vessel, the neutron-absorbing emergency coolant can only flow into the reactor core. Pipes through the closure head to the pressure vessel and pipe coupling are, for safety reasons, designed in such a way that sideward displacements are possible. Part of the control rod guide tubes as well as the hollow supports are designed as downward leading pipelines to the reactor core. (GE)

11356 ADSORBED OFF-GAS DELAY BED ASSEMBLY FOR RADIOACTIVE GASES. Queiser, H.; Schwarz, H. (to Licentia Patent-Verwaltungs-G.m.b.H.). German(FRG) Patent 2,133,250/B/. 13 Feb 1975. 4p. (In German)

2 figs.

Equipment is described for the adsorbed delay of radioactive off-gases in nuclear reactors, which solves the problems of heat removal, shielding, as well as safe exchangeability of the adsorbant in a simple manner. It consists of a cylindrical vessel filled with adsorbant with a conical lower part. In the vessel, an immersion tube from the top to introduce the off-gases is centrally inserted and leads into the conical part where there are favorable conditions for heat removal. The most greatly loaded adsorbant here can be drained by a slide value and removed by a safe transporting device. The vessel is situated between shielding plates with appropriate pipe passages for radiation shielding. By selecting suitable dimensions, it may be used as pre- and main absorber. (GE)

11357 SECONDARY PROCESS FOR SECURING EMERGENCY COOLING IN NUCLEAR FACILITIES. Bachl, H. German(FRG) Patent 2,342,263/A/. 27 Mar 1975. 5p. (In German)

3 figs.; 5 refs.

An auxiliary process for securing the emergency cooling of nuclear power plants is described which is characterized in that a two-material heat power auxiliary process is connected at the cold end of the cooling circuit to a main heat power process to obtain mechanical energy from thermal, which in normal operation works as a cold-absorption process, but with failure of the main process changes to a heat power process with full evaporation and subsequent superheating of the two-materials mixture. (GE)

11358 THERMAL EFFECTS ON THE CONNECTICUT RIVER: PHYCOLOGY AND CHEMISTRY. Foerster, J. W.; Trainor, F. R.; Buck, J. D. J. Water Pollut. Control Fed.; 46: No. 9, 2138-2152 (1974).

Thermal discharges into the Connecticut River from the Connecticut Yankee Atomic Power Station and other sources creates a DELTAT that acts as a stimulator for the floral community and reinforces other factors that are detrimental to water quality. The effects of the thermal discharges on the phytoplankton and phycoperiphyton were studied. (SFL)

11359 ASSESSMENT OF SAFETY AND ENVIRONMENTAL HAZARDS ASSOCIATED WITH THE OPERATION OF NUCLEAR REACTORS. Gileadi, A. E.; Musalem, A. (Univ. of Puerto Rico, Mayaguez). pp 77-78 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).

From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

Reactor Theory and Calculation

11360 (CEA-CONF-3026) DIGITAL SOLUTIONS OF SOME PROBLEMS BORDERING ON NUCLEAR ENGINEERING. Goldstein, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service des Etudes Mecaniques et Thermiques). 1974. 15p. (In French). INIS.

From Euromech 53rd colloquium on thermoplasticity; Jablona, Poland (15 Sep 1974).

The essential features of the PASTEL code, developed at the Saclay Nuclear Research Centre and using the method of finite elements in bidimensional geometry, are outlined. Some examples of application are given: development of stresses in a graphite block of a HTR reactor; creep in fast reactor vessel; shock between two blocks of graphite; and thermoplastic cycle. (FR)

11361 (CONF-751116-8) MULTIVARIATE STATISTICAL PATTERN RECOGNITION SYSTEM FOR REACTOR NOISE ANALYSIS. Gonzalez, R. C.; Howington, L. C.; Sides, W. H. Jr.; Kryter, R. C. (Oak Ridge National Lab., Tenn. (USA)). 1975. 9p. Dep. NTIS $4.50.

From nuclear science symposium; San Francisco, California, USA (17 Nov 1975).

A multivariate statistical pattern recognition system for reactor noise analysis was developed. The basis of the system is a transformation for decoupling correlated variables and algorithms for inferring probability density functions. The system is adaptable to a variety of statistical properties of the data, and it has learning, tracking, and updating capabilities. System design emphasizes control of the false-alarm rate. The ability of the system to learn normal patterns of reactor behavior and to recognize deviations from these patterns was evaluated by experiments at the ORNL High-Flux Isotope Reactor (HFIR). Power perturbations of less than 0.1 percent of the mean value in selected frequency ranges were detected by the system. 19 references. (auth)

11362 (NP-20592) SOLUTION OF DIFFUSION EQUATIONS FOR VARIOUS GROUPS BY THE FINITE ELEMENT METHOD. Sanchez, C. A. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Fisica y Matematicas). Jul 1975. 120p. (In Spanish). Dep. NTIS (US Sales Only) $9.00.

Thesis.

The DELFIN code was implemented to resolve neutron scattering equations in two dimensions, obtained by applying the approximation of various energy groups. The code works with any number of groups and regions and is applicable to both thermal and fast reactors. By supplying the scattering coefficients, the cross sections, and the fission spectrum it produces the multiplication constant of the system and the fluxes of each group. The code was developed by using the finite element method which is one form of resolving the variational formulation of the equations applying the Ritz-Galerkin method with continuous polynomial functions by parts, in the present case of the Lagrange type with rectangular geometry up to the third order. The results obtained and the comparison with literature results lead to the conclusion that it is advantageous to use rectangular elements in all cases where the geometry permits it. The advantages of the finite element method over the finite difference method are shown. (tr-auth)

11363 (RT/FI-(75)8) NOISE ANALYSIS STUDIES: INTERNATIONAL MAILING LIST OF SPECIALISTS. Colombino, A.; Jorio, V. M.; Mosiello, R.; Norelli, F.; Pacilio, N. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Apr 1975. 41p. Dep. NTIS (US Sales Only) $5.00.

11364 (VTT-YDI-12) CAFIRI: A FORTRAN PROGRAM FOR CALCULATION OF CAPTURE ON FISSION RESONANCE INTEGRALS BY IR-TYPE METHODS. Hoeglund, R. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Ydinvoimateknillkan Lab.). 1974. 51p. (In Swedish). Dep. NTIS (US Sales Only) $5.75.

CAFIRI is a computer programme for the calculation of resonance integrals. The integrals are computed using either the NR approximation or one of the six different alternative versions of the IR approximation included in the code. The system studied is a hexagonal or square lattice of cylindrical fuel rods. The heterogeneity of the system is taken account of by introducing suitable expressions for the collision probabilities which contain Dancoff and Bell factors. The fuel cladding can be treated according to five alternative methods. The integrals are influenced by resonance interaction; the importance of this effect is estimated by expanding the integrand of the resonance integral in a geometrical series in which the first term is the ordinary resonance integral and the other terms are corrections for the interaction with other resonances. Unresolved resonances are not treated separately by CAFIRI. 17 references. (auth)

11365 ANALYSIS OF COUPLED-REACTORS STABILITY. Podowski, M. (Politechnika Warszawska (Poland). Instytut Techniki Cieplne). Atomkernenergie; 26: No. 1, 7-11(1975).

8 refs.

The stability of a coupled-reactor model with linear feedback is investigated. The method of analysis is based on transformation of reactor kinetics equations to the form of an operator equation defined in a Banach space. Using two particular Banach spaces the properties of solution of the considered reactor model are investigated and the conditions of asymptotic stability of a stationary point are formulated. (auth)

11366 EFFECT OF ABSORBER RODS ON THE SPACE-ENERGY DISTRIBUTION OF THERMAL NEUTRONS IN WATER. Hussein, A. Z.; Eid, Y.; Hamouda, I. (Atomic Energy Establishment, Cairo (Egypt). Reactor and Neutron Physics Dept.). Atomkernenergie; 26: No. 1, 21-24(1975).

6 figs.; 1 tab.; 10 refs.

Thermal neutron spectra have been measured in a vectorial direction with respect to cadmium, boron-filled and copper rod elements. The rods are infinite cylinders, of 21 mm diameter, each seperately immersed in an infinite water moderator fed with neutrons from the ET-RR-1 research reactor. Measurement of spectra has been carried out, in the vicinity of the rod elements, at several distances by the time-of-flight method using a chopper and also by intergral flux activation method. The measured spectra near the copper rod were compared with transport calculations of the position-dependent spectrum. The calculations, based on a realistic kernel for water, were found to yield reasonable agreement with experiment. (auth)

11367 REYNOLDS NUMBER AND FRICTION COEFFICIENT FOR AXIAL-PARALLEL FLOW THROUGH COMPLEX CROSS-SECTIONS. Markfort, D. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Koeln (F. R. Germany)). Atomkernenergie; 25: No. 4, 288-292(1975). (In German)

4 figs.; 11 refs.

The thermal and hydraulic lay-out of reactor fuel elements and other heat transfer equipment makes use of established functional relationships between dimensionless characters, the former being transferred from circular tubes to more complex geometries. The stringent requirement (from theory) for "geometrical similarity" is bypassed by defining "equivalent diameters". But dimensionless numbers may be derived from "flow-integral-conditions" while the geometrical components contained therein reduce if not completely abolish the requirement for geometrical similarity. The derivation is demonstrated by using the Reynolds number. A friction coefficient valid for any kind of flow regime can be defined using integral-conditions. Correlations of friction coefficient and Reynolds number using universal-velocity profiles confirm the analysis when compared to well known experimental data. (auth)

11368 EXPERIMENTAL AND THEORETICAL INVESTIGATIONS ON SOLID BURNABLE POISON BURNUP OF MODEL ARRANGEMENTS. Ahlf, J.; Anders, D.; Greim, L.; Knoth, J.; Kolb, M.; Mittelstaedt, B.; Mueller, A.; Schwenke, H. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). Atomkernenergie; 25: No. 2, 91-97(1975). (In German)

From KTG-special meeting "long-term behavior"; Stuttgart, F. R. Germany (25 Feb 1975). 13 figs.; 2 tabs.; 8 refs.

Two experiments are reported to improve the methods for computation and measurement of burnable poison rod burnup. In the first experiment, two nine-rod bundles in a 3 × 3 arrangement are irradiated during several irradiation periods in the research reactor Geesthacht. Each bundle consists of eight outer rods containing fuel and one inner rod containing poison (^{10}B or ^{113}Cd). The burnup of the fuel and the burnable poison is measured by non-destructive methods after each irradiation period and then compared with results of a burnup calculation. In the second experiment, two poison rods with different cadmium concentrations and one rod containing boron are irradiated during several irradiation periods in the research reactor Geesthacht. The burnup is determined after each irradiation period by reactivity measurements and its result compared to computed effective absorption cross-sections of the rods by aid of a calibration curve. For both experiments, the experimental and theoretical results for the poison burnup are found to be within the error limits of the measurements. (auth)

11369 PHYSICS MEASUREMENTS AT POWER REACTORS: METHODS AND RESULTS. Gruen, A. (Kraftwerk Union A. G., Erlangen (F. R. Germany)). Atomkernenergie; 25: No. 2, 98-102(1975). (In German)

10 figs.; 2 tabs.

One source of experimental information to the reactor designer is the observation and evaluation of normal power operation. It yields: (1) Stationary and nonstationary power density distributions and quantities derived from them such as hot channel factors and burnup distributions; the primary experimental quantities are detector signals which have to be converted to power density by calculation. (2) Excess reactivity as a function of burnup; it is determined in terms of soluble poison concentration or control rod position. Special measuring programs constitute a second source of experimental information. They yield reactivity coefficients and equivalents which describe the dynamic behaviour of the reactor during normal operation and possible accidental transients. Kinetic as well as static measuring methods are applied. They usually yield combined reactivity coefficients or reactivity integrals. A consequent check of the theoretical design methods has to refer as far as possible to directly measurable quantities; this may require incorporation of special options into the design calculation programs. (auth)

11370 EINFUEHRUNG IN DIE KERNREAKTOR- UND KERNKRAFTWERKSTECHNIK. T. 1. Kernphysikalische Grundlagen, Reaktorphysik, Reaktordynamik. (Introduction to Nuclear Reactor and Nuclear Power Plant Techniques. I. Foundations, Reactor Physics, Reactor Dynamics). Oldekop, W. (Technische Univ. Braunschweig (F. R. Germany). Lehrstuhl fuer Raumflugtechnik und Reaktortechnik). Thiemig-Taschenbuecher. Muenchen, F. R. Germany; Thiemig (1975). 272p.

47 refs.; with figs.

After a general introduction into nuclear physics fundamentals, the book deals with problems of reactor physics, i.e. neutron diffusion and slowing-down, stationary and kinetic reactor theory on the basis of the multigroup diffusion equations without a transport theory. (GE)

11371 OPTIMUM POWER SHAPE STRATEGIES FOR GIVEN REACTOR END OF FUEL CYCLE CONDITIONS. Fadilah, S. (Alexandria Univ., Egypt). J. Inst. Nucl. Eng.; 16: No. 4, 102-104(Jul 1975).

For a given initial loading and a given design limit for the power peaking factor, and because of the inconsistency between the needs for a flat power shape and for a maximum average discharge burnup, the choice of a control rod program throughout the cycle poses an optimization problem This problem is discussed and is referred to as "control rod programming" or "poison management optimization." (auth)

11372 NEUTRON WAVE PROPAGATION IN MULTIPLYING ASSEMBLIES WITH AND WITHOUT CONTROL RODS. Difilippo, F. C. (Comision Nacional de Energia Atomica, Buenos Aires). Ann. Nucl. Energy; 2: No. 6, 483-494(Jul 1975).

The dispersion law is expanded in a power series of the frequency up to the third order, using two-group diffusion theory. The nuclear parameters of this approximation can be related with those observed experimentally in a closed and definite form. A model is developed that predicts the existence of an asymptotic propagation mode even in the presence of control rods; this model permits the wave front and the dispersion law to be calculated. The models are compared with experiments done in a highly compact system with 90% U 235 enriched uranium fuel and water moderator. (auth)

11373 REMARKS ON THE USE OF WELL-KNOWN REACTIVITY MEASURING TECHNIQUES BY THE PULSED-SOURCE METHOD. Kosaly, G.; Valko, J. (Magyar Tudomanyos Akademia, Budapest). Ann. Nucl. Energy; 2: No. 6, 477-482(Jul 1975).

A mistake in the usual derivation of the Gozani method is pointed out and its effect is demonstrated. In an example the spatial bracketing feature of the Sjöstrand method is used to obtain a better estimate of the reactivity than by other methods. (auth)

11374 DETERMINATION OF PARAMETERS OF A NUCLEAR REACTOR THROUGH NOISE MEASUREMENTS. Cohn, C. E. (to U. S. Energy Research and Development Administration). US Patent 3,894,912. G21C17/00. 15 Jul 1975. Filed date 21 Dec 1973. 6p.

A method of measuring parameters of a nuclear reactor by noise measurements is described. Noise signals are developed by the detectors placed in the reactor core. The polarity coincidence between the noise signals is used to develop quantities from which various parameters of the reactor can be calculated. (auth)

Reactor Components and Accessories

Refer also to abstracts 9207, 9212, 9306–9313, 9801, and 11089.

11375 (AECL-5124) PROCEEDINGS OF THE SPECIALISTS' MEETING ON IN-CORE INSTRUMENTATION AND FAILED FUEL DETECTION AND LOCATION, MISSISSAUGA, ONTARIO, MAY 13–15, 1974. Pearson, A.; Lynch, G. F.; Lipsett, J. J. (eds.). (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jun 1975. 377p. (CONF-740537-). AECL $5.00.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

Twenty-two papers are presented on the instrumentation and systems used for reactor in-core neutron flux monitoring and for detection of fuel element failures. A separate abstract was prepared for each of 20 papers. Two papers were previously processed for NSA. (HDR)

For abstracts of individual papers see: 9306–9313, 11226, 11242–11244, 11246–11249, 11278, and 11376–11378.

11376 (AECL-5124, pp 7-18) SELF-POWERED IN-CORE DETECTORS OF COBALT TYPE. Jonsson, G. (AB Atomenergi, Studsvik, Sweden). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

The program to develop and test neutron-sensitive self-powered detectors for in-core use in BWR and PWR type reactors is reviewed. Test results using cobalt detectors are examined, and the potential advantages of vanadium detectors are discussed. (HDR)

11377 (AECL-5124, pp 67-73) IN-CORE SELF POWERED NEUTRON DETECTORS. Turcotte, G. E. (Pickering Generating Station, Pickering, Ont.). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Some of the problems in interpreting the signal output from in-core self powered neutron detectors are discussed. The total signal consists of a prompt signal representing the reactor flux and a background signal due to ^{60}Co and ^{61}Co buildup. Characteristic detector responses as a function of irradiation time are presented, and correction methods used to determine the prompt component are discussed. (HDR)

11378 (AECL-5124, pp 77-93) SOME PRACTICAL CONSIDERATIONS IN THE USE OF SELF-POWERED FLUX DETECTORS. Shields, R. B. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Jun 1975.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

In proceedings of the specialists' meeting on in-core instrumentation and failed fuel detection and location. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Experience gained by the AECL in the use of in-core self-powered neutron flux detectors is reviewed. Aspects of detectors use discussed include the choice of detector type, the physical installation, electrical measurements, and interpretation of output signals. (HDR)

11379 (CEA-CONF-2930) NEUTRON DETECTORS FOR NUCLEAR REACTOR CONTROL. Duchene, J.; Verdant, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Services d'Electronique). 9 Dec 1974. 25p. (In French). (CEA-SES-PUB-SAI-74-257). INIS.

From one-day meeting on electronic instrumentation for nuclear reactor control; Paris, France (18 Dec 1974).

In view of the importance of in-core measurements the distinction is made between detectors used outside and inside the core. In the former case proportional counters, fission chambers and boron chambers are reviewed. The only in-core detectors considered are those giving a direct measurement, i.e. supplying an electric signal representative of the neutron fluence rate while in the measurement position at the point given. Two kinds of detectors are used for direct measurements: miniature fission chambers and collectors, known also as neutron-electron converters. (FR)

11380 (CEA-CONF-2986) ANALYSIS OF THE VIBRATIONS OF THE INTERNAL STRUCTURES OF A WATER REACTOR. Jeanpierre, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service des Etudes Mecaniques et Thermiques). 1974. 19p. (In French). INIS.

From France-Soviet colloquium; Obninsk, USSR (7 Dec 1974).

The response of the "basket", shield and flow separation sleeve of the reactor to flow-induced stresses was determined in two stages: study of the characteristic frequencies and associated characteristic modes, and estimation of the excitation force with calculation of the response. The calculation was carried out by applying the method of finite elements to shells in the form of figures of revolution using the Revomode code. The maximum displacement obtained is less than $\frac{1}{10}$ mm. (FR)

11381 INCREASED RELIABILITY AND OPTIMIZED OPERATION: A NECESSITY IN POWER STATION ENGINEERING. II. Measures. Kuhlmann, A. (Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (F. R. Germany)); Oude-Hengel, H. H. (Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (F. R. Germany)., Abt. Grosskraftwerke). Brennst.-Waerme-Kraft; 27: No. 6, 247-251(Jun 1975). (In German)

9 figs.; 1 tab.

The measures for reliability improvements are discussed, e.g., the introduction of theoretical methods, the improvement of testing techniques and methodology, and the application of ergonomic knowledge. (auth)

11382 DETERMINATION OF THE IRRADIATION PARAMETERS OF STRUCTURAL MATERIALS IN PILES. Genthon, J. P.; Salon, L. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France)). Nucl. Eng. Des.; 33: No. 1, 2-6 (Aug 1975). (In French).

Problems of neutronic parameters for radiation damage experiments are briefly reviewed. These are the problems of fluence, flux level (or irradiation time) and temperature. In particular the GAMIN graphite detector, which measures "graphite flux" and r spectrum indices (graphite/nickel), is described. The results of an international set of r indices are summarized. (NL)

11383 THE DEFINITION OF DAMAGE FUNCTIONS FROM IRRADIATION TEST DATA. Yoshikawa, H. H.; McElroy, W. N.; Simons, R. L. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Nucl. Eng. Des.; 33: No. 1, 11-18(Aug 1975).

A method of determining irradiation effectiveness of different neutron spectra in causing radiation effects to fuel cladding and reactor structural materials is described. It involves the definition of a semi-empirical damage function or cross section using measured data from specimens irradiated in thermal and fast test reactor spectra. The damage function is applied to design problems involving irradiation effects to reactor structural and fuel cladding materials to predict the fluence which would produce a specific change in material properties. (NL)

11384 DESIGN OF FAST REACTOR BOILERS. Foster, G. G.; Taylor, P. A. (Babcock and Wilcox Ltd., London). pp 274-284 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society conference; Reading, England (25 Sep 1974).

The paper reviews the various styles of steam generators being considered by design teams throughout the world and draws attention to the properties of the tube materials needed to meet the designers' requirements. The various candidate materials now under consideration are examined in the light of these requirements, notably strength and the various corrosion phenomena to which they may be subjected and highlights the present uncertainties associated with each of those materials. Recommendations are made for the development work needed to resolve these uncertainties. In the light of present information, however, it is concluded that the best choice of boiler style for a fast reactor is the once-through helically wound tube system having a monometallic tubulation and alloy 800 is recommended as the preferred material. To take advantage of the good stress-corrosion resistance of the low-carbon stabilized version of this alloy in the grade 1 condition and yet avoid the low creep ductility of this type at the design temperatures, it is suggested that the best compromise is to specify this low carbon alloy but with controlled total Al and Ti content and in the high temperature (grade 2) heat-treated condition. (auth)

Reactor Fuels

11385 TUBULAR ELECTRIC HEATER WITH A THERMOCOUPLE ASSEMBLY. House, R. K.; Williams, D. E. (to U. S. Atomic Energy Commission). US Patent 3,898,431. H05b3/40. 5 Aug 1975. Filed Date 29 Jan 1974. 6p.

PAT-APPL-438,149.

This patent relates to a thermocouple or other instrumentation which is installed within the walls of a tubular sheath surrounding a process device such as an electric heater. The sheath comprises two concentric tubes, one or both of which have a longitudinal, concave crease facing the other tube. The thermocouple is fixedly positioned within the crease and the outer tube is mechanically reduced to form an interference fit onto the inner tube. (auth)

Reactor Control Systems

11386 (AEEW-M-1366) FURTHER RESULTS OBTAINED BY TUTANK FOR A TWO-DIMENSIONAL KINETICS BENCHMARK PROBLEM. Halsall, M. J. (UKAEA Reactor Group, Winfrith, Atomic Energy Establishment). Oct 1975. 13p. Dep. NTIS (US Sales Only) $4.50.

Revised results are presented for an LWR two-dimensional neutron kinetics benchmark problem. Earlier calculations were made with a single mesh point per channel and a consequent high rod worth. The new calculations have been made, firstly with a 2×2 mesh representation, and secondly with the combination of

single mesh representation and partial rod withdrawal which gives the same rod worth as the finer mesh. (auth)

11387 (JUL-947-RE) CONCEPT OF THE PLATE-SHAPED FORK ABSORBER FOR 10 MW OPERATION OF THE FRJ-1. Bormann, H. J.; Katscher, W.; Meessen, H.; Muench, E.; Thamm, G. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralabteilung Forschungsreaktoren).. May 1973. 56p. (In German). Dep. NTIS (US Sales Only) $5.50.

The concept of the plate-shaped fork absorber, which successfully for several years in the French light water-moderated research reactor, was studied for the 10 MW operation of the FRJ-1. In comparison with other variants, this concept fulfills best the requirements on low flux density over-increase in the absorber gap in extended absorbers, on high reactivity efficiency, and on low space requirements in the absorber special element. The version used in the FRJ-1 is shown in its engineering conception. Conventional studies on the flow conditions in the absorber element, absorber drop behavior, and the temperature conditions in the absorber special element were described and nuclear measurements of the neutron flux density and the reactivity efficiency were reported. The possible occurrence of the buckling of an absorber plate was considered and discussed extensively. (tr-auth)

11388 CONCEPT OF A CONTROL AND SHUTDOWN ROD FOR THE PEBBLE BED REACTOR WITH OTTO CHARGING. Haas, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralabteilung Allgemeine Technologie). Kerntechnik; 17: No. 7, 316-319(Jul 1975). (In German, English)

2 figs.

A control and shutdown rod has been designed and built following the specifications for a pebble bed reactor with OTTO charging. The rod is moved by a rotary spindle driven by an electric motor via an electromagnetically commutable gearing. The components located in the primary helium atmosphere are designed taking into account the special difficulties arising in a pure helium atmosphere. The reliability and the safety of this control and shutdown rod are discussed. (auth)

11389 QUICK RELEASE LATCH FOR REACTOR SCRAM. Johnson, M. L.; Shawver, B. M. (to U. S. Energy Research and Development Administration). US Patent 3,905,634. G21C7/08. 16 Sep 1975. Filed date 4 Jun 1974. 8p.

PAT-APPL-476,184.

A simple, reliable, and fast-acting means for releasing a control element and allowing it to be inserted rapidly into the core region of a nuclear reactor for scram purposes is described. A latch mechanism grips a coupling head on a nuclear control element to connect the control element to the control drive assembly. The latch mechanism is closed by tensioning a cable or rod with an actuator. The control element is released by de-energizing the actuator, providing fail-safe, rapid release of the control element to effect reactor shutdown. A sensing rod provides indication that the control element is properly positioned in the latch. Two embodiments are illustrated, one involving a collet-type latch mechanism, the other a pliers-type latch mechanism with the actuator located inside the reactor vessel. (auth)

11390 MICROCOMPUTER CONTROL OF THE LYNCHBURG POOL REACTOR. Smoak, R. A.; Scott, H. D. (Babcock and Wilcox Co., Lynchburg, VA). pp 65-67 of Conference on Research, Test and Training Reactors. Charlottesville, VA; Univ. of Virginia (1974).

From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974). See CONF-740841-.

Nuclear Power Plant Economics

Refer also to abstract 11200.

11391 (CEA-CONF-3007) ROLE AND IMPORTANCE OF NUCLEAR POWER IN THE FULFILLMENT OF ENERGY NEEDS. Giraud, A. (CEA, 75 - Paris (France)). 21 Apr 1975. 34p. (In French). INIS.

From 1st European nuclear conference; Paris, France (21 Apr 1975).

A set of graphs illustrates: the comparative costs of electricity and heat production by fossil fuel and nuclear power stations; energy needs until 2030 and the future of oil; the problem of raw materials for the development of nuclear energy in the exclusive case of light-water reactors, in the case where other types of reactor excluding breeders are introduced and in the case where breeders are included; worldwide reprocessing needs. (FR)

11392 (INIS-mf-1785) BASIC INFORMATION ABOUT THE BRAZILIAN NUCLEAR TECHNOLOGY COMPANY. Objectives, Organization, Projects and Activities. (Companhia Brasileira de Technologia Nuclear, Rio de Janeiro (Brazil). Directoria de Tecnologia e Desenvolvimento). 1974. 53p. (In Portuguese). INIS.

The organization of nuclear energy activities in the Ministry of Mines and Energy is described. Following is a description of the objectives and organization of the Brazilian Nuclear Technology Company. An overview is given of the Brazilian nuclear program. An analysis is made of market and costs for the introduction of nuclear energy into the country. Finally, the principal projects of the Company are discussed. (INIS)

11393 (JUL-1230) ENERGY EXPENDITURE FOR THE CONSTRUCTION AND OPERATION OF NUCLEAR POWER PLANTS. Kolb, G.; Niehaus, F.; Rath-Nagel, S.; Voss, A. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany)). Aug 1975. 77p. (In German). Dep. NTIS (US Sales Only) $6.00.

The overall energy input of different nuclear power plant types (comprising the nuclear fuel cycle) is computed and compared with a coal-fired plant. Moreover a time-dependent energy balance for the expansion of nuclear capacity according to the existing nuclear programs is calculated. Even applying only Light Water Reactors the nuclear expansion program (with an installed capacity of $50GW_{el}$ in 1985 and 170 GW_{el} in 2000) would result in an accumulated fossil fuel saving of approximately the tenfold amount of primary energy consumed in the Federal Republic of Germany yearly today. 21 references. (auth)

11394 INTO THE ABYSS. Norman, C. Nature (London); 257: No. 5525, 346-349(2 Oct 1975).

Present energy policy in the USA is reviewed, with special reference to nuclear energy, and recent administrative changes in the atomic energy field are described. Although the policy assumes there will be a marked expansion of the nuclear power programme, with perhaps as many as 1000 nuclear power stations in operation by the year 2000, nevertheless the industry is now experiencing some of the toughest political and economic challenges it has ever faced. These challenges are discussed, and include probable energy demand, reactor safety, Pu problems with the LMFB reactor, and waste disposal. (UK)

11395 BREEDER REACTOR IN THE U. S.: A NEW ECONOMIC ANALYSIS. Bupp, I. C. (Harvard Univ., Cambridge, MA); Derian, J. C. Technol. Rev.; 76: No. 8, 26-36(1974).

Approximately half of the U. S. energy research and development budget for fiscal year 1974 was applied to the liquid metal fast breeder reactor (LMFBR) program. The economics of this program are examined by a comparison of LMFBR and light water reactor capital and operating costs. It is concluded that the LMFBRs will be competitive only if they can be built at a construction cost no greater than $50/kW above light water reactor costs and if uranium prices rise above $50/lb. The questionable prospects for these conditions to come about indicates the need for a more balanced energy research and development effort. (HDR)

11396 ENERGY ACCOUNTING AND NUCLEAR POWER. Brookes, L. G. (United Kingdom Atomic Energy Authority, London). Atom (London); No. 227, 164-168(Sep 1975).

It is stated that some people have claimed that nuclear power may consume more energy that it produces, and the theme has been taken up by some prominent individuals and by environmentalist pressure groups. In the opinion of the UKAEA—and other expert bodies—these claims are misconceived. The author explains how they came to be made in the first place and why they should be dismissed. (auth)

Reactor Licensing and Regulation

Refer also to abstract 11297.

11397 (DOCKET-50259-677) BROWNS FERRY NUCLEAR POWER STATION, UNITS 1, 2, AND 3. Semiannual Report, January-June 1975. (Tennessee Valley Authority, Chattanooga (USA)). 1975. 38p. (DOCKET-50260-455; DOCKET-50296-230). Dep. NTIS $5.00.

Browns Ferry units 1 and 2 operated at maximum power from January 1 to March 22 except as limited by thermal margins, fuel preconditioning, optimum power shape, maintenance, and Unit 2 start-up tests. On March 22 a cable tray fire started causing spurious starting of equipment due to faulted control cables. The reactors were manually scrammed and placed in cold shutdown for fire investigation, clean up, and fuel removal. Information is also presented concerning maintenance, radiochemistry, occupational radiation exposure, release of radioactive materials, and non-radiological environmental monitoring. (FS)

11398 (DOCKET-50313-381) ARKANSAS NUCLEAR ONE, UNIT 1. Semiannual Operating Report, January–June 1975. (Arkansas Power and Light Co., Little Rock (USA)). 4 Sep 1975. 743p. Dep. NTIS $40.25.

Net electrical power generated was 2,025,115 MWH with the reactor on line 2,915.1 hours. Information is presented concerning power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, release of radioactive materials, and abnormal occurrences. Non-radiological environmental surveillance is summarized and complete meteorological data are included. (FS)

11399 (DOCKET-STN-50546-1) MARBLE HILL NUCLEAR GENERATING STATION, UNITS 1 AND 2. License Application, PSAR, General Information. (Public Service Co. of Indiana, Inc., Plainfield (USA)). 1 Jul 1975. 102p. (DOCKET-STN-50547-1). Dep. NTIS $8.25.

An application is presented for two PWR reactors to be constructed in Salud Township, Jefferson County, Indiana, about six miles northeast of New Washington on the Ohio River. Each unit will have a rated core power level of 3411 MW(t) with a corresponding electrical output of 1130 MW(e). Mechanical draft cooling towers will be provided. The facility, which will replicate the Byron facility will be employed for the generation of electricity for transmission, sale for resale, and distribution. (FS)

11400 (FIND-50448-R1) FIND: DOUGLAS POINT NUCLEAR GENERATING STATION, UNITS 1 AND 2. Moore, M. M. (ed.). (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Dec 1975. 25p. Dep. NTIS $4.00.

This index is presented as a guide to microfiche items 1 through 136 in Docket 50448, which was assigned to Potomac Electric Power Company's Application for Licenses to construct and operate Douglas Point Nuclear Generating Station, Units 1 and 2. Information received from August, 1973 through July, 1975 is included. (auth)

11401 IAEA PROGRAM FOR THE PREPARATION OF SAFETY CODES AND GUIDES FOR NUCLEAR POWER PLANTS. IRS Kurz-Inf., Reihe C; 26: No. 12, 1-4(Jul 1975). (In German).

On the 13th of September, 1974, the IAEA Govenors' Council gave its consent to the program for the establishment of safety codes and guides. The program envisages the establishment of one code of practice for each of the governmental organizations, siting, design, operation and quality assurance and also of about 50 safety guides between 1975 and 1980. These codes will contain the minimum requirements for the safety of the nuclear power stations, their systems and components. The guides will recommend methods to achieve the aims stated in the codes. It is the purpose of these IAEA activities to provide recommendations and guiding rules which may serve as standards for the assessment of the safety of nuclear power stations for all nations which may become participants in the peaceful use of nuclear energy within the next few years. (GE)

11402 IS THE ENERGY SUPPLY THREATENED BY PROTESTING CITIZENS. Schmidt-Kuester, W. J. (Bundesministerium fuer Forschung und Technologie, Bonn (F. R. Germany)). Umsch. Wiss. Tech.; 75: No. 13, 395(Jul 1975). (In German)

By the year 1980 twenty new nuclear power plants should be in operation supplying 25% of the electricity. By 1985 another twenty nuclear power plants should be ready to take over altogether 45% of the electricity. The German nuclear industry is prepared for this production volume. Some trouble is caused by initiatives of citizens protesting against special sites which leads to delays. This means that planning will have to start earlier to stay within the time schedules. (auth)

11403 STUDIE UEBER DEN DERZEITIGEN STAND UND DIE ZUKUENFTIG ANZUSTREBENDE AUSBILDUNG DER MIT DER LEITUNG BEAUFTRAGTEN ANGESTELLTEN UND VON OPERATEUREN FUER REAKTORANLAGEN. Abschlussbericht zum Vorhaben RS 70 im Auftrage des Bundesministers fuer Bildung und Wissenschaft. (Study on the Present and Future Training of Managers and Operators for Reactor Facilities. Final Report on the Project RS 70 Sponsored by the Federal Minister of Education and Science). Hagemann, G.; Preuss, W.; Tietze, A.; Wuest, S. (comps.). Koeln, F. R. Germany; TUeV Rheinland (Sep 1973). 199p.

With figs., tabs. and refs.; with apps.

The study gives a survey on the training methods for the operating personnel of reactors in operation or under construction in the FRG and compares them with the training and testing methods of other countries, in particular the USA. (GE)

GENERAL AND MISCELLANEOUS

Information Handling

Refer also to abstracts 9647–9650.

11404 (INIS-mf-1710) INIS: A SUCCESSFUL EXPERIMENT IN OPERATING A DECENTRALISED, COMPUTER-BASED, MISSION-ORIENTED INFORMATION SYSTEM. Raghavendra Rao, M. K.; Kamath, V. A. (Bhabha Atomic Research Centre, Bombay (India)). 1975. 20p. INIS.

From 3rd international study conference on classification research; Bombay, India (6 Jan 1975).

16 refs., 4 appendices.

The concept of operating a decentralised information handling system on an international basis had remained untried for long. International Nuclear Information System (INIS), sponsored by the International Atomic Energy Agency (IAEA), is the first of its kind in operation today, which has demonstrated the feasibility of the UNISIST concept. The problems involved in the development of INIS and its operation in a highly decentralised environment, particularly due to the participation of Member States with varied economic and technological development, professional experience and facilities are highlighted. India's performance as the ninth largest inputting centre of nuclear literature to INIS, is par excellence among all the developing countries participating in the System. The salient design features of INIS, most suitable for decentralised operation, are discussed in detail. The difficulties experienced in maintaining a high standard of subject indexing due to decentralised input preparation and the techniques adopted by INIS to ensure clean input going into the INIS Data Bank are described. The advantages of a computerised error checking procedure in a large data handling system are briefly touched upon. The degree of reliability of INIS, in relation to the precision at the time of retrieval, requires longer testing time. The recent translation of INIS Thesaurus into French and Russian for retrieval purpose constitutes a forward step towards the feasibility of future multi-lingual global systems. The importance of competent indexing personnel both for inputting operation and SDI work is stressed. The recent developmental efforts in respect of AGRIS and DEVSIS based on INIS experience and software are indicative of the achievement of INIS programme. (auth)

Law

11405 KELVIN AND THE CONTROL OF ENVIRONMENTAL HAZARDS. Lenihan, J. M. A. (National Radiological Protection Board, Glasgow, Eng.). Radiol. Prot. Bull.; No. 12, 13-15(Jul 1975).

The Royal Commission on Arsenical Poisoning appointed by King Edward VII in 1901 under the chairmanship of Lord Kelvin produced Reports (Cd 459, 692, 1845, 1848, and 1869, HMSO 1901 to 1903) which were historic documents, for they enunciated many of the principles afterwards used in the administrative control of radiation hazards, and, more recently, of other environmental hazards. Their main recommendation was that it should be an offence under the Food and Drugs Acts to sell liquid or solid foods containing more than specified proportions of arsenic. The concept of a tolerance dose was forcefully rejected, and the levels of 0.01 grains of arsenic per gallon or per pound were based on practical considerations of manufacturing practices, analytical techniques and toxicity studies on rats. Kelvin and his fellow commissioners recommended the establishment of a scientific body strangely like the modern National Radiological Protection Board, to provide continuing scientific advice and to formulate and enforce what would now be called a Code of Practice. Although Kelvin never came to terms with radiation, his philosophy on environmental hazards and his detailed advocacy of a scientific Board of Reference are now recognizable as major contributions to radiology. (UK)

11406 ANNOUNCEMENT ON THE SCOPE OF APPLICATION OF THE AGREEMENT ON THE PRIVILEGES AND EXEMPTIONS OF THE INTERNATIONAL ATOMIC ENERGY AGENCY. Bundesgesetzblatt, Teil 2; No. 15, 267(1975). (In German)

The German Democratic Republic does not feel bound by articles 26 and 34 of the Convention enacting obligatory jurisdiction of the International Court of Justice. With regard to the jurisdiction of the International Court of Justice in controversies arising from the interpretation or application of the Convention, the GDR holds the view that in every single case the consent of all parties concerned is necessary for the commitment of a specific controversy to the jurisdiction of the International Court of Justice. This reservation also applies to the terms under article 34 according to which the opinion of the International Court of Justice is considered to be of binding force. (GE)

Management

11407 (ERDA-63-75) PHYSICAL RESEARCH PROGRAM: RESEARCH CONTRACTS AND STATISTICAL SUMMARY. (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Physical Research). 1 Jul 1975. 41p. Dep. NTIS $5.25.

The physical research program consists of fundamental theoretical and experimental investigations designed to support the objectives of ERDA. The program is directed toward discovery of natural laws and new knowledge, and to improved understanding of the physical sciences as related to the development, use, and control of energy. The ultimate goal is to develop a scientific underlay for the overall ERDA effort and the fundamental principles of natural phenomena so that these phenomena may be understood and new principles, formulated. The physical research program is organized into four functional subprograms, high-energy physics, nuclear sciences, materials sciences, and molecular sciences. Approximately four-fifths of the total physical research program costs are associated with research conducted in ERDA-owned, contractor-operated federally funded research and development centers. A little less than one-fifth of the costs are associated with the support of research conducted in other laboratories. (RWR)

11408 12 BILLION DM FOR GERMANY. Wirtschaftswoche.; 29: No. 27, 12-16(Jun 1975). (In German)

The German atomic industry has achieved the break-through to the world market: Brazil orders eight nuclear electricity generating plants from Siemens-AEG daughter Kraftwerk-Union. US concerns attacked the twelve billion DM deal, the biggest export order in the history of German industry. The contract is to be signed in Bonn. (GE)

11409 NUCLEAR POWER AND ENERGY SUPPLY. The Role of the Research Centers. Beckurts, K. H.; Eidens, J. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)). Atomwirtsch., Atomtech.; 20: No. 7, 354-358(Jul 1975). (In German)

From reactor conference; Nuernberg, F. R. Germany (8 Apr 1975). 1 tab.

German nuclear research centers have made important contributions in the fields of research, development and training and in this way helped to catch up with the lead of other countries in nuclear research and technology and to launch nuclear power as a new source of energy in the Federal Republic of Germany. Some years ago it appeared as if these objectives had all been fulfilled, and the question arose as to the justification of the continued existence of these nuclear research centers; at least a shift of their activities to non-nuclear sectors was demanded. However, in reality only a starting point had been reached from which to develop advanced reactor systems and tackle new problems connected with a highly complex energy problem with ramifications that did not become apparent until a few years ago. In the long term phase of the energy problem there will be a gradual complete substitution of fossil fuels by other sources of energy, the continuity of supply being ensured first by fast breeder reactors and later on by nuclear fusion. The nuclear research centers will have to solve these problems in an increasingly closer cooperation and a division of labor among themselves and with industry. In the long run, most of their activities will continue to be in nuclear fields. (GE)

11410 MANPOWER EMPLOYMENT IN THE CIVIL NUCLEAR ENERGY FIELD. Resbser, J. (Bundesministerium fuer Forschung und Technologie, Bonn); Banister, D. G. Nucl. Eng. Int.; 20: No. 233, 618-620(Aug 1975).

Data collected from thirteen European countries with interests in civil nuclear energy, in a survey in manpower employment in this field, are presented and analyzed. The survey covered personnel engaged in civil nuclear work in industry and in the laboratories and administration of national and international organizations. The data are analyzed by area of work and level of activity. (UK)

Mathematics and Computers

Refer also to abstracts 9404, 9981, 11089, 11110, and 11364.

11411 (CNRS-CPT-74-P-602) SPECTRAL SUBSPACES AND THEIR APPLICATIONS TO AUTOMORPHISM GROUPS. Olesen,

D. (Centre National de la Recherche Scientifique, 13–Marseille (France). Centre de Physique Theorique). Mar 1974. 58p. INIS.

An attempt is made to give a survey of the theory of spectra and spectral subspaces of group representations in an abstract Banach space setting. The theory is applied to the groups of automorphisms of operator algebras (mostly C*-algebras) and some important results of interest for mathematical physicists are proved (restrictions of the bitransposed action, spectral subspaces for the transposed action on a C*-algebra, and positive states and representations of R^n). (FR)

11412 (CNRS-CPT-75-P-703) SELF-ADJOINTNESS OF UNBOUNDED DERIVATIONS ON C*-ALGEBRAS. Bratteli, O. (Centre National de la Recherche Scientifique, 13–Marseille (France). Centre de Physique Theorique). Feb 1975. 14p. (In French). INIS.

From convegno sulle algebre C* e loro applicazioni in fisica teorica; Rome, Italy (12 Mar 1975).

Various criteria on an unbounded derivation on a C*-algebra which ensures that the derivation is the infinitesimal generator of a strongly continuous one-parameter group of *-automorphisms are discussed. Results obtained by R. T. Powers, D. W. Robinson, S. Sakai and the author during the last year are surveyed and systematized. A couple of new results are also included. (FR)

11413 (CRN/HE-75-3) MINI-COMPUTER IN STANDARD CAMAC. Meyer, J. M.; Perrin, J.; Lecoq, J.; Tedjini, H.; Metzger, G. (Centre National de la Recherche Scientifique, 67–Strasbourg (France). Centre de Recherches Nucleaires). 1975. 22p. (In French). INIS.

CAMAC is the designation of rules for the design and use of modular electronic data-handling equipment. The rules offer a standard scheme for interfacing computers to transducers in on-line systems. Where systems do not need a large memory capacity or where computing power is provided by an associated computer, a processor implemented in a CAMAC structure will be of a great interest for such a standard. In a way such a processor with an INTEL 8008 CPU chip with use of a CAMAC crate, a memory bus, an 1/0 bus or CAMAC horizontal Dataway and a bus connecting the CPU to the operator's panel was built. The interrupt system has six levels. To allow multi-programmation, the 8008's instruction set was extended with the creating of a Jump and mark instruction. A multi-task operating system was implemented allowing the execution of real time tasks, process control and program debugging. Three units have been built nowadays for: process control, education, test of CAMAC modules, image processing. (FR)

11414 (JUL–964-MA) CALCULATION OF THE WEIERSTRASS ZETA AND SIGMA FUNCTIONS. Eckhardt, U. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Zentralinstitut fuer Angewandte Mathematik). Jun 1973. 46p. (In German). Dep. NTIS (US Sales Only) $5.00.

The definitions for the Weierstrass zeta and sigma functions are directly investigated. The zeta function is defined as a sum and the sigma function as a product. The sum or the product were exactly formed over a small aggregate of lattice points. For a larger aggregate of lattice points they were exactly calculated up to a controllable approximation. The rest of the lattice points were "smeared" to an integral. An approximate formula was found which in relatively large regions yields usable approximations for the zeta and sigma functions. All values occurring can be numerically calculated, and the error can be reliably estimated. The solutions were applied to the theory of superconductivity. 5 figures, 11 tables. (JSR)

11415 (UCCND-CSD-3) MONTE CARLO SAMPLING OF SUBJECTIVE PROBABILITY ESTIMATES. Van Wie, N. H. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Nuclear Div.). Dec 1975. Contract W-7405-eng-26. 54p. Dep. NTIS $5.45.

This program was prepared for the purpose of sampling and analyzing subjective probability estimates about a mineral resource in an area subdivided into smaller geographic entities. Estimates from over 30 geologists were expressed in probabilistic terms for attributes of numbers of deposits and tons/grade of ore for each of over 60 geographic areas. The functional application of the program is described elsewhere [GJO-109], and this report is intended to facilitate its usage or modification in a local installation. In the discussion herein, a "sample" consists of generating pseudorandom numbers, testing them against two cumulative distribution functions for each of 3332 ore body descriptions, and compilation of pertinent statistics. (3 figures) (auth)

11416 NUCLEAR SCHOOL (46). I. Practical Handling of the Finite Element Method. Stelzer, F. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralabteilung Allgemeine Technologie). Kerntechnik; 17: No. 7, 324-328(Jul 1975). (In German, English)

2 figs.; 1 tab.; 4 refs.

In the two parts of this basic explanation, the procedure for producing finite element programs is shown in a generally understandable manner. The first part treats the path from the differential equation up to the equations for a finite element. The second part shows the extension of the element equations to a continuum. (GE)

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